



Motion Control

Selection Guide



Bringing Together Leading Brands in Industrial Automation

Introduction

Important User Information

This guide has been developed as a quick reference tool for Allen-Bradley® motion controls and systems. It is not intended to replace user manuals or technical documentation supplied with our Allen-Bradley equipment, which should be referred to for actual installation, connection, operation, and maintenance of A-B equipment.

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to ensure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

Reproduction of the contents of this copyrighted publication, in whole or in part without written permission of Allen-Bradley Company, Inc. is prohibited.

Allen-Bradley and PLC are registered trademarks of Rockwell Automation.

ControlLogix, ControlNet, DeviceNet, Data Highway Plus, DeviceNet, GML, IMC, Logix, RSLogix 5000, SCANport, SLC, SLC 5/03, SLC 5/04, SLC 5/05, Smart Motor, SoftLogix, SoftLogix5800, Ultraware, Ultra5000, Ultra5000-DN, Ultra3000, Ultra3000i, Ultra3000-SE, Ultra3000X-DN, and Ultra3000-DN are trademarks of Rockwell Automation.

IBM is a registered trademark of International Business Machines Corporation.

Microsoft, Windows, Windows 95, Windows 98, Windows 2000, and WindowsNT are registered trademarks of Microsoft Corporation.

Pentium and Pentium II are registered trademarks of Intel Corporation.

Hiperface is a registered trademark of Stegmann Inc.

UL and C-UL are registered trademarks of Underwriters Laboratories.

SERCOS interface is a trademark of the Interests Group SERCOS interface e.V. (IGS)

Preface

What is Motion Control?	P-1
What is a Motion Control System?	P-1
Selecting Your Motion Control System Components . .	P-1
Motion Controllers Selection Chart	P-2
Motors Selection Chart	P-4
Programming Software Selection Chart	P-4
Contents of this Guide.	P-4
How to Get More Information	P-5

Logix™

Chapter 1

ControlLogix.	1-1
System Overview	1-2
1756-M02AE Servo Module	1-3
1756-M02AE Servo Module Specifications	1-3
1756-M02AE Servo Module Catalog Number	1-5
Terminal Board Connection Data	1-6
1756-M08SE 8-Axis SERCOS Interface Servo Module . .	1-7
1756-M08SE 8-Axis SERCOS Interface Module Specifications	1-8
1756-M08SE 8-Axis SERCOS Interface Module Catalog Number	1-9
SoftLogix	1-10
PC Requirements for SoftLogix	1-10
System Overview	1-11
1784-PM02AE 2-Axis SoftLogix Servo Card	1-12
1784-PM02AE 2-Axis SoftLogix Servo Card Specifications	1-13
1784-PM02AE 2-Axis SoftLogix Servo Card Catalog Number	1-14
Termination Panel	1-15
Termination Panel Wiring Connection Data.	1-15
1784-PM02AE Termination Panel Catalog Number	1-17

Digital Servo Drives

Chapter 2

Ultra3000 Digital Servo Drives	2-1
Ultra3000 Architectures.	2-2
Ultra3000i Indexing Digital Servo Drives	2-2
Ultra3000-SE Digital Servo Drives with SERCOS Interface	2-5
Ultra3000-DN Digital Servo Drives with DeviceNet Interface	2-6
Ultra3000 Digital Servo Drive System Overview	2-8
Ultra3000 Power Ratings	2-9
Ultra3000 Digital Servo Drive Specifications	2-10
General Specifications	2-10
Physical and Environmental Specifications	2-11

Power Input Specifications	2-11
Power Dissipation Specifications	2-12
Controller Specifications	2-12
Inputs/Outputs Specifications	2-12
Serial Communications Specifications	2-13
Ultra3000-SE SERCOS Communication Specifications.	2-13
Ultra3000-DN DeviceNet Communication Specifications.	2-13
Feedback Specifications.	2-14
Serial Communication Port Specifications	2-14
Connectors Specifications	2-14
Ultra3000 Digital Servo Drive Dimensions	2-15
Ultra3000 and Ultra3000i Connector Data	2-19
I/O Connector Pins and Signals (CN1)	2-20
Motor Encoder Connector Pins and Signals (CN2)	2-21
Serial Port Connector Pins and Signals (CN3)	2-21
Terminal Block	2-22
Ultra3000-SE Connector Data	2-23
I/O Connector Pins and Signals (CN1)	2-25
Motor Encoder Connector Pins and Signals (CN2)	2-25
Serial Port Connector Pins and Signals (CN3)	2-26
Terminal Block	2-26
Ultra3000-DN and -X-DN Connector Data	2-27
I/O Connector Pins and Signals (CN1)	2-30
Motor Encoder Connector Pins and Signals (CN2)	2-30
Serial Port Connector Pins and Signals (CN3)	2-31
Terminal Block	2-31
Ultra3000 Digital Servo Drive Catalog Number.	2-31

Intelligent Positioning Drives

Chapter 3

Ultra5000 Intelligent Positioning Drives	3-1
Ultra5000-DN DeviceNet Intelligent Positioning Drive	3-1
Ultra5000 Intelligent Positioning Drive System Overview	3-2
Ultra5000 Power Ratings	3-2
Ultra5000 Intelligent Positioning Drive Specifications	3-3
General Specifications	3-3
Physical and Environmental Specifications	3-3
Power Input Specifications	3-3
Power Dissipation Specifications	3-4
Inputs/Outputs Specifications	3-4
Feedback Specifications.	3-5
Serial Communication Port Specifications	3-5
Connectors Specifications	3-5

Ultra5000 Intelligent Positioning Drive Dimensions . . .	3-6
Ultra5000 Connector Data.	3-8
Digital I/O Connector Pins and Signals (CN1A) . . .	3-8
Auxiliary Encoder and Analog I/O Connector	
Pins and Signals (CN1B)	3-9
Motor Encoder Connector Pins and Signals (CN2) .	3-9
Serial Port Connector Pins and Signals	
(CN3A and CN3B)	3-10
Terminal Block.	3-10
Digital I/O Connector Pins and Signals (CN1A) . .	3-11
Auxiliary Encoder and Analog I/O Connector	
Pins and Signals (CN1B)	3-12
Motor Encoder Connector Pins and Signals (CN2)	3-12
Serial Port Connector Pins and Signals	
(CN3A and CN3B)	3-13
DeviceNet Connector Pins and Signals (P2)	3-13
Terminal Block.	3-13
Ultra5000 Intelligent Positioning Drives	
Catalog Number	3-13

1394 Drive System Family

Chapter 4

The 1394 Family	4-1
What is the 1394 System?	4-1
1394 System Modules.	4-2
1394 System Module Series Information.	4-2
System Modules Specifications.	4-3
1394 System Module Dimensions.	4-5
GMC Turbo	4-6
System Module Catalog Numbers.	4-7
1394 Axis Modules.	4-10
1394 Axis Module Series Information.	4-10
1394 Axis Modules Specifications.	4-11
1394 Drive Interface Module	4-12
1394 DC Link Module	4-13
1394 Axis Module, Drive Interface Module, and	
DC Link Module Dimensions	4-14
1394 Axis Modules Catalog Number.	4-16
1394 External Shunt Modules	4-17
1394 Shunt Resistor Kit for 5 and 10 kW	
System Modules Catalog Number	4-17
1394 Shunt Modules for 22 kW System Modules	
Catalog Number	4-18
1394 Drive System Family Architectural Overview . .	4-18
1394 GMC System.	4-18
1394 SERCOS Interface System	4-20
1394 9/Series CNC Interface System.	4-21
1394 Analog Servo System.	4-22

General System Specifications	4-23
Environmental Specifications	4-23
Relay Contact Specifications	4-23
User-Supplied Contactor (M1) Specifications	4-23
User-Supplied Input Fusing Specifications	4-24
User-Supplied 24V Logic Input Power Specifications	4-24
Input Transformer Specifications for 24V Control Power	4-24
1394 System Power Dissipation Specifications	4-25
Miscellaneous Specifications	4-27

Software

Chapter 5

RSLogix 5000	5-1
PC Requirements	5-1
RSLogix 5000 Workspace	5-2
Developing a Motion Control Application Program	5-4
RSLogix 5000 Instructions	5-6
Motion Instructions	5-6
RSLogix 5000 Ladder Logic Programming	5-8
Creating and Editing Motion Application Performance Profiles	5-9
Cam Profile Editor Workspace	5-9
Editing and Viewing Motion Application Performance Profiles	5-11
RSLogix 5000 Programming Software Catalog Number	5-11
Ultraware	5-12
PC Requirements	5-12
Ultraware Drive Set-Up	5-13
Ultraware Workspace	5-14
Ultraware Windows	5-15
Commissioning Ultra3000 and Ultra5000 Drives with Ultraware	5-16
Developing Ultraware Cam Profiles for the Ultra5000	5-18
Programming the Ultra5000 with Ultraware	5-19
Programming an Ultra5000 Intelligent Positioning Drive	5-20
Ultraware Motion Library Commands	5-20
Host Communications	5-22
Ultraware Catalog Number	5-22
GML Commander	5-23
PC Requirements	5-23
GML Commander Workspace	5-24
GML Commander Catalog Number	5-28

Motors

Chapter 6

Brushless Servo Motors	6-1
Determining Which Motor to Use	6-1
F-Series Motors	6-3
General Specifications.	6-4
Motor Dimensions	6-6
F-4000 NEMA 56C Dimensions	6-8
Load Force Ratings	6-9
Brake Specifications and Application Guidelines	6-9
Encoder Data	6-10
Connector Data	6-11
Wire Sizing Recommendations.	6-12
F-Series Motor Catalog Number	6-12
H-Series Motors	6-13
General Specifications.	6-14
Motors Dimensions	6-16
H-4000 NEMA 56C Dimensions	6-18
Load Force Ratings	6-19
Brake Specifications and Application Guidelines	6-20
Encoder Data	6-21
Connector Data	6-21
Wire Sizing Recommendations.	6-22
H-Series Motor Catalog Number	6-23
MP-Series Motors	6-24
MP-Series Standard Encoder Features.	6-25
MP-Series Options	6-25
230V General Specifications	6-26
460V General Specifications	6-29
Motors Dimensions	6-32
Load Force Ratings	6-38
Encoder Data	6-39
Brake Specifications and Application Guidelines	6-40
Connector Data	6-41
Wire Sizing Recommendations.	6-42
MP-Series Motor Catalog Number	6-43
N-Series Motors	6-44
General Specifications.	6-45
Motor Dimensions	6-48
Load Force Ratings	6-50
Shaft Load Force Ratings.	6-50
Brake Specifications and Application Guidelines	6-51
Encoder Data	6-51
Connector Data	6-52
Wire Sizing Recommendations.	6-53
N-Series Motor Catalog Number.	6-53

Y-Series Motors	6-54
General Specifications	6-55
Motors Dimensions	6-57
Load Force Ratings	6-58
Brake Specifications and Application Guidelines.	6-59
Encoder Data	6-59
Connector Data.	6-60
Wire Sizing Recommendations.	6-61
Y-Series Motor Catalog Number.	6-61
1326AB Series Motors	6-62
Feedback Options.	6-62
Motor Options	6-63
General Specifications	6-64
Motors Dimensions	6-69
Load Force Ratings	6-72
Integral Holding Brake	6-73
1326AB Series Motor Catalog Number	6-74
1326AS Series Motors	6-75
Motor Options	6-76
General Specifications	6-77
Motors Dimensions	6-80
Load Force Ratings	6-84
Integral Holding Brake	6-85
1326AS Series Servo Motor Catalog Number	6-86
General Motor Performance Definitions.	6-87

System Combinations

Chapter 7

Ultra3000 and Ultra5000 Drives with F-Series Motors	7-1
Ultra3000 and Ultra5000 Drives with H-Series Motors.	7-3
Ultra3000 and Ultra5000 Drives with 230V	
MP-Series Motors	7-7
Ultra3000 and Ultra5000 Drives with N-Series Motors	7-11
Ultra3000 and Ultra5000 Drives with 115V	
Y-Series Motors.	7-14
Ultra3000 and Ultra5000 Drives with 230V	
Y-Series Motors.	7-15
1394 Drive/Axis Modules with 460V MP-Series	
Motors	7-17
1394 Drive/Axis Modules with 1326AB Motors.	7-20
1394 Drive/Axis Modules with 1326AS Motors.	7-26

Motion Control Accessories

Chapter 8

2098 Ultra Family Drive Systems	8-1
Ultra Family Cable Connections.	8-1
Ultra Family Motor Cable Combinations	8-2
Ultra Family Cable Dimensions	8-3

Ultra Family Cable Specifications	8-9
Ultra Family Cable Catalog Numbers	8-10
Ultra Family Cable Connection and Functionality Charts	8-12
Break Out Board Components	8-14
Ultra Family Connector Kits	8-19
Ultra Family AC Line Filters	8-21
Ultra Family Shunt Resistor Kits	8-26
Ultra Family Motor Shaft Seal Kits	8-28
2098 Ultra Family Motor Shaft Seal Kit Catalog Number	8-28
1394 System Family	8-29
1394 System Module Cable Dimensions	8-29
1394 System Module Cable Specifications	8-30
1394 System Module Cable Catalog Numbers	8-31
1394 AC Line Filters	8-32
1394 External Shunt Kit and Modules	8-34
1394 Shunt Module Specifications	8-35
1394 Shunt Module Dimensions	8-36
1394 Shunt Module Catalog Numbers	8-38
MP-Series 460V Servo Motor Cables	8-39
Dimensions	8-39
Specifications	8-40
Pinouts	8-41
460V MP-Series Motor Cable Catalog Numbers	8-43
1326AB and 1326AS Motor Cables for 1394 System Family	8-44
1326 Cable Dimensions	8-45
1326 Cable Bend Radius Information	8-48
1326AB and 1326AS Servo Motor Cable Specifications	8-49
1326 Connection Solutions with 1394 System Modules	8-50
1326AB and 1326AS Servo Motor Catalog Numbers	8-54
1326 Motor Cable Pin-outs	8-56
1326AB Motor Feedback Mounting Adapters for 1394 Family	8-60
1326AB and 1326AS Motor Junction Box Kits for 1394 Family	8-62
1394 Motion Control System Motor Shaft Seal Kits	8-65
1394 Miscellaneous Accessories	8-67

Preface

Read this preface to familiarize yourself with the rest of the guide. This preface covers the following topics:

- What is Motion Control?
- What is a Motion Control System?
- Selecting Your Motion Control System Components
- Contents of this Guide
- How to Get More Information

What is Motion Control?

Motion control is the management of movement. Motion control replaces and improves mechanical systems through precise electronic control, solving the most difficult of application challenges.

Motion control devices for position control products help improve the performance of material handling systems, automated machinery and machine tools by shortening required positioning time and coordinating machine movements.

What is a Motion Control System?

A motion control system shortens positioning time and, consequently, increases production throughput such as the manufacture of parts or the labeling of packages. A motion control system also coordinates machine movements by eliminating the mechanical interface, reducing overall application costs.

Any application that would benefit from an increase in accuracy, reliability and repeatability would benefit from the implementation of a motion control system. Motion control systems increase accuracy by closing tolerances for higher precision. Motion control systems increase reliability by extending the life of mechanical hardware. Finally, motion control systems increase repeatability by improving production yields and decreasing scrap.

Selecting Your Motion Control System Components

The tables that follow allow you to select the components you will need to set up your motion control system.

The Motion Controllers Selection Chart allows you to choose a controller and verify what features are and are not available for this controller. The Motors Selection Chart allows you to determine what motor(s) can be used with each controller. The Programming Software Selection Chart allows you to determine what software you will need to program your controller.

Motion Controllers Selection Chart

Product Feature	1394 GMC ¹	1394 GMC Turbo ¹	ControlLogix (1756-M02AE) ²	ControlLogix (1756-M08SE) ²
Axis Control				
Number of Axes	Up to 4	Up to 4	2/ Card and Up to 32/Controller	8/Card and Up to 32/Controller
Point to Point Positioning	Yes	Yes	Yes	Yes
Blended Moves	Yes	Yes	Yes	Yes
Coordinated Positioning (Contouring)	Yes	Yes	NA	NA
Axis Link	Yes (32 axes)	Yes (64 axes)	NA	NA
Servo Loop Update Time	1-2 ms	1-2 ms	0.2 ms	Drive Dependent
Electronic Gearing (Ratioing)	Yes	Yes	Yes	Yes
Position Lock Camming	Yes	Yes	Yes	Yes
Time-Lock Camming	Yes	Yes	Yes	Yes
Programming Language				
Ladder Logix Programming	No	No	Yes	Yes
GML Programming	Yes	Yes	NA	NA
MML Programming	No	No	No	No
Function Block Programming	No	No	Yes	Yes
Sequential Function Charts	No	No	NA	NA
Structured Text Programming	No	No	NA	NA
ANSI C Programming Language	No	No	NA	NA
User Programming Memory	32 kb	64 kb	3.5 Mbyte	3.5 Mbyte
Number of Programs	1	1	32/Task	32/Task
Number of Tasks	10	10	32/Controller	32/Controller
Servo Drives				
Analog Servo Interface	No	No	Yes	No
Digital Servo Interface	Yes	Yes	No	No
SERCOS interface	No	No	NO	Yes
Auto Position Loop Tuning	Yes	Yes	Yes	Yes
Auto Velocity Loop Tuning	Yes	Yes	Yes	Yes
I/O Control				
Remote I/O Adapter	Yes	Yes	Interface Module Required	Interface Module Required
Remote I/O Scanner	No	No	Interface Module Required	Interface Module Required
Ethernet	No	No	Interface Module Required	Interface Module Required
ControlNet	No	No	Interface Module Required	Interface Module Required
DeviceNet™	No	No	Interface Module Required	Interface Module Required
Local PLC I/O	No	No	Interface Module Required	Interface Module Required
Local General Purpose Inputs	up to 128	up to 128	Interface Module Required	Interface Module Required
Local General Purpose Outputs	up to 128	up to 128	Interface Module Required	Interface Module Required
Flex I/O Interface	Yes	Yes	Interface Module Required	Interface Module Required
Analog I/O	Yes	Yes	Interface Module Required	Interface Module Required
Local Operator Interface				
Serial Terminal	RS232/422	RS232/422	PLC	PLC
PanelView 1200/1400	No	No	PLC	PLC
PanelView 550/900	DH485	DH485	PLC	PLC
DTAM Plus	DH485	DH485	PLC	PLC
DTAM Micro	Yes	Yes	PLC	PLC
Feedback Devices				
Incremental Encoder	Yes	Yes	Yes	Drive Dependent
High Resolution Encoder	No	No	No	Drive Dependent
Absolute Encoder	Yes (Converter)	Yes (Converter)	Yes (Converter)	Drive Dependent
Resolver	Yes	Yes	Yes (Converter)	Drive Dependent
Temposonic	Yes (Converter)	Yes (Converter)	Yes (Converter)	Drive Dependent

¹ For more complete product listings and information, refer to *1394 Drive System Family*.

² For more complete product listings and information, refer to *Logix*.

SoftLogix5800 (1784-PM02AE) ²	Ultra3000 ³	Ultra5000 ⁴
Up to 32/Controller	1.5	1.5
Yes	Yes (Indexing Only)	Yes
Yes	Yes (Indexing Only)	Yes
NA	No	Yes
NA	No	No
0.2 ms	1 ms	0.5 ms
Yes	Yes	Yes
Yes	No	Yes
Yes	No	No
Yes	No	No
Yes	No	No
NA	No	No
NA	No	No
NA	No	No
No	No	Yes
RAM	NA	512 kb
32/Task	NA	Multiple
32/Controller	NA	NA
No	Yes	No
No	Yes	Yes
No	Yes	No
Yes	Yes	No
Yes	Yes	No
Interface Module Required	No	No
Interface Module Required	No	No
Interface Module Required	No	No
Interface Module Required	No	No
Interface Module Required	Yes	Yes
Interface Module Required	No	No
Interface Module Required	8	16
Interface Module Required	4	8
Interface Module Required	No	No
Interface Module Required	Yes	Yes
Yes	Yes	Yes
RAM	No	Yes (DF-1)
RAM	No	Yes (DF-1)
RAM	No	No
RAM	No	No
Yes	Yes	Yes
No	Yes	Yes
Yes (Converter)	Yes	Yes
Yes (Converter)	Yes (Converter)	No
No (Converter)	Yes (Converter)	Yes (Converter)

³ For more complete product listings and information, refer to *Digital Servo Drives*.

⁴ For more complete product listings and information, refer to *Intelligent Positioning Drives*.

Motors Selection Chart

Motors	1394 SERCOS Interface	1394 GMC	1394 GMC Turbo	1394 GMC Analog	Ultra3000	Ultra5000
F-Series (Medium Inertia)	No	No	No	No	Yes	Yes
H-Series (Low Inertia)	No	No	No	No	Yes	Yes
MP-Series (Low Inertia) (230V)	No	No	No	No	Yes	Yes
MP-Series (Low Inertia) (460V)	Yes	No	No	No	No	No
N-Series (Medium Inertia)	No	No	No	No	Yes	Yes
Y-Series (Low Inertia)	No	No	No	No	Yes	Yes
1326AB Series (Medium Inertia)	Yes	Yes	Yes	Yes	No	No
1326AS Series (Low Inertia)	Yes	Yes	Yes	Yes	No	No

Programming Software Selection Chart

Software	1394 SERCOS Interface	1394 GMC	1394 GMC Turbo	Ultra3000	Ultra5000
RSLogix 5000 (V 9.0)	Yes	No	No	No	No
Ultraware	No	No	No	Yes	Yes
GML Commander	No	Yes	Yes	No	No

Contents of this Guide

Chapter	Title	Contents
	Preface	Describes the purpose and scope of this guide.
1	Logix	Provides features, benefits, specifications and dimensions for the ControlLogix and SoftLogix platforms.
2	Digital Servo Drives	Provides features, benefits, specifications and dimensions for Ultra3000 digital servo drives.
3	Intelligent Positioning Drives	Provides features, benefits, specifications and dimensions for Ultra5000 digital servo drives.
4	1394 Drive System Family	Provides features, benefits, specifications and dimensions for all members of the 1394 Drive System Family.
5	Software	Provides features, benefits, specifications, and screen captures of RSLogix 5000 (Version 9.0), Ultraware, and GML Commander.
6	Motors	Provides features, benefits, specifications and dimensions for F-, H-, LD-, MP-, N-, W-, Y-, 1326AB-, and 1326AS-Series motors.
7	System Combinations	Provides torque/speed curves, motor power cables, and feedback cables for the Ultra5000, Ultra3000 and 1394 drive-motor combinations.
8	Accessories	Provides the dimensions, specifications, and catalog numbers for the Bulletin 2098 Ultra Family and the Bulletin 1394 System Family accessories.

How to Get More Information

- For electronic copies of installation instructions, visit the Manuals Online website (www.ab.com/manuals/gmc/).
- To order motion control publications, visit The Automation Bookstore (www.theautomationbookstore.com).
- For technical support, call (440) 646-5800 or fax (440) 646-5801. You can also E-Mail technical support at RACleAsktheExpert@ra.rockwell.com.
- For more motion product information, specifications, and a variety of other tools that take the complexity out of motion control, obtain a copy of Motion Book 3.2 from the Automation Bookstore (www.theautomationbookstore.com).

Logix™

The Logix platforms that can support your motion control application include ControlLogix™ and SoftLogix™. Refer to the following sections for information regarding these Logix platforms.

ControlLogix

A ControlLogix system looks like a programmable controller, but it is much more. The ControlLogix platform is state-of-the-art modular control which provides sequential, motion, drive, and process control support.

A ControlLogix system features:

- Modular, chassis-based platform.
- Wide variety of control processes and I/O module options.
- Wide variety of high performance communication options.
- Wide variety of motion control and interface module options.
- Support of RSLogix 5000™ programming software for motion and sequential control.

The ControlLogix products available for your motion control application include:

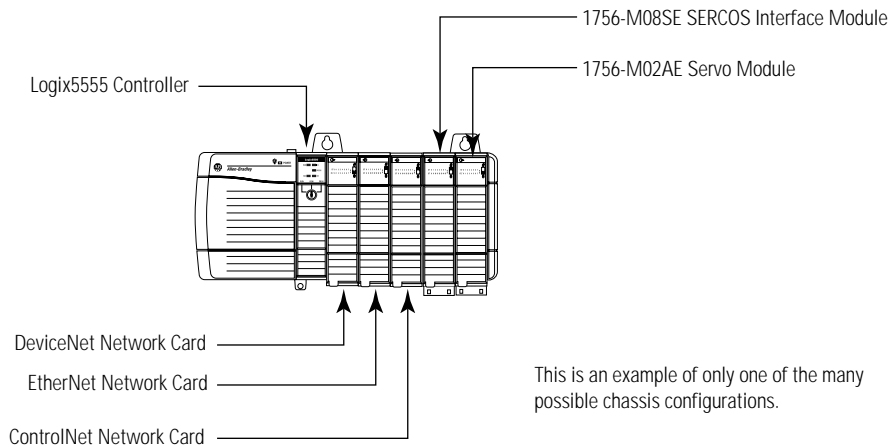
- 1756-M02AE Analog Servo Module
- 1756-M08SE SERCOS interface™ Module

For more information regarding ControlLogix, refer to the *ControlLogix Selection Guide* (publication 1756-SG001A-EN-P).

System Overview

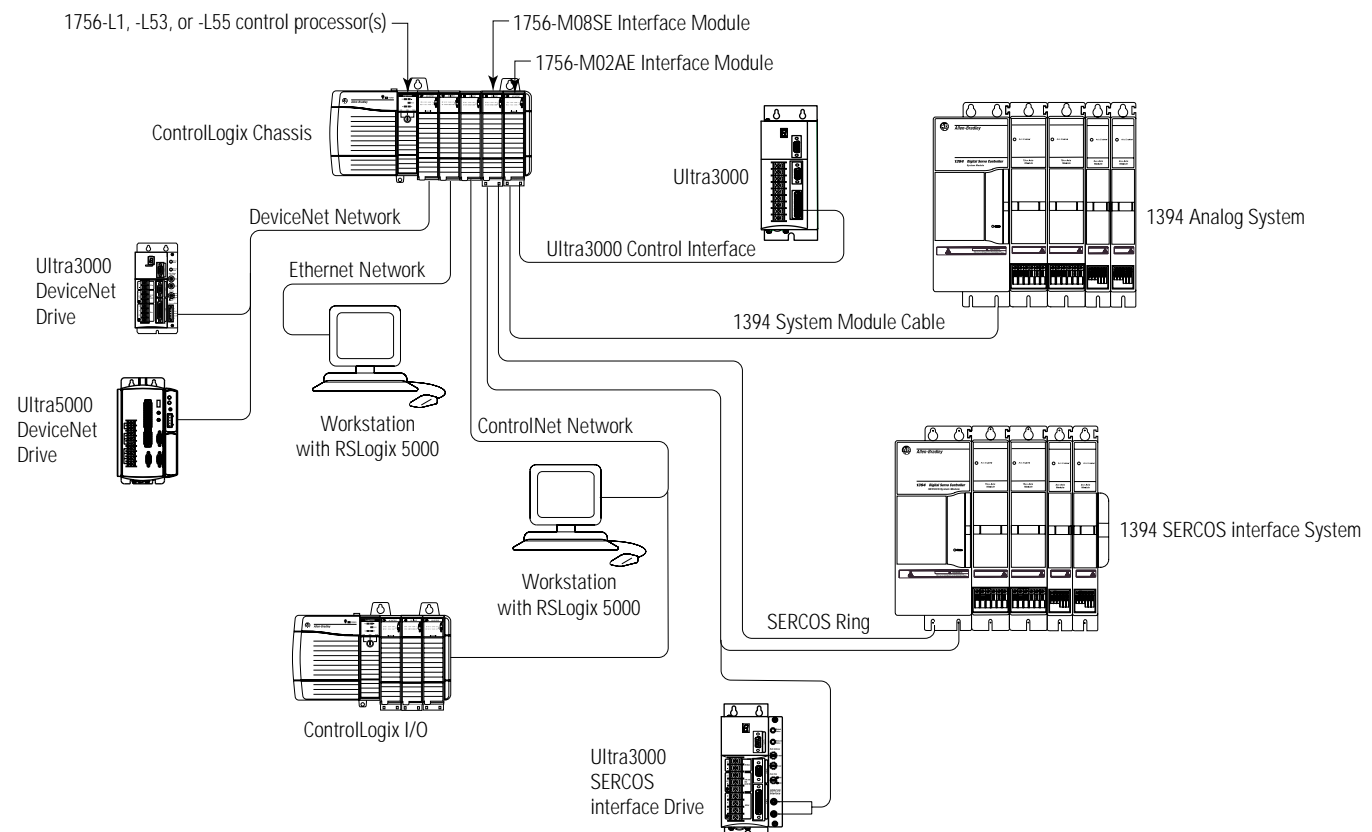
A ControlLogix system is modular, as shown in the figure below.

Figure 1.1
ControlLogix Chassis



As shown in the figure below, you can select the network and the type and number of controllers based on the needs of your application. This flexibility lets you share system resources and divide applications across multiple controllers.

Figure 1.2
ControlLogix System



1756-M02AE Servo Module



The 1756-M02AE servo module is a 2-axis, closed-loop servo module that receives profile information from the ControlLogix controller. The servo module ensures that the actuator (motor) follows the profile by monitoring the position feedback via the quadrature encoder input and generating an analog command reference for the drive. A position and velocity loop is closed every 200 μ s using position feedback as the input and provides ± 10 V analog output.

The 1756-M02AE servo module features:

- Connectivity and control of two drives.
- Fast position and velocity updates that allow the most advanced application solutions to be solved.
- UL® listed.
- CSA listed.
- CE marked for all applicable directives.

IMPORTANT

The servo module must be in the same chassis as the ControlLogix controller that controls the servo module. If you distribute motion control across different locations, place a ControlLogix controller in each chassis that has a servo module.

1756-M02AE Servo Module Specifications

The following section contains general, input, output, servo loop and environmental specifications for the 1756-M02AE servo module.

General Specifications

Specification	Description
Number of axes per ControlLogix controller	32 axes maximum (i.e., 16 cards controlled by 1 ControlLogix controller)
Number of axes per module	2 axes maximum
Module Location	1756 ControlLogix chassis
Module Keying	Electronic
Power dissipation	5.5W maximum
Backplane current	<ul style="list-style-type: none"> • 700 mA @ 5V DC • 2.5 mA @ 24V DC • 3.56W

Input Specifications

Specification	Description
Encoder input	Incremental AB quadrature with marker
Type	4X quadrature
Mode	4 MHz counts per second maximum
Rate	Optically isolated 5V differential
Electrical interface	
Voltage range	3.4V to 5.0V
On state	0V to 1.8V
Off state	531 Ohms differential
Input impedance	
Registration inputs	
Type	Optically isolated, current sinking input
24V input voltage	+24V dc nominal
Maximum	26.4V
Minimum on	18.5V
Maximum off	3.5V
5V input voltage	+5V dc nominal
Maximum	5.5V
Minimum on	3.7V
Maximum off	1.5V
Input impedance	
24V input	9.5 kOhms
5V input	1.2 kOhms
Response time (position latched)	1µs
All other inputs	
Type	Optically isolated, current sinking input
Input voltage	+24V dc nominal
Maximum	26.4V
Minimum on	17.0V
Maximum off	8.5V
Input impedance	7.5 kOhms
Drive Faults and Home Inputs	
Type	Optically isolated, current sinking input
Input voltage	+24V DC nominal
Maximum	26.4V
Minimum on	17.0V
Maximum off	8.5V
Input impedance	7.5 kOhms

Output Specifications

Specification	Description
Servo output	
Type	Analog voltage
Isolation	200 kOhms
Voltage range	±10V
Voltage resolution	16 bits
Load	5.6 kOhms resistive minimum
Maximum offset	25 mV
Gain error	±4%
All other outputs	
Type	Solid-state isolated relay contacts
Operating voltage	+24V dc nominal (Class 2 source)
Maximum	26.4V
Operating current	75 mA

Servo Loop Specifications

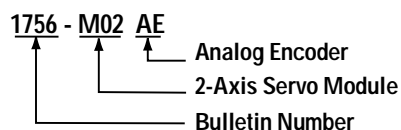
Specification	Description
Servo loop	
Type	Nested PI digital position and velocity servo
Gain resolution	32-bit floating point
Absolute position range	±1,000,000,000 encoder counts
Rate	5 kHz

Environmental Specifications

Specification	Description
Ambient Temperature	Storage: -40° C to 85° C (-40° F to 185° F) Operation: 0° C to 60° C (32° F to 140° F)
Backplane current	<ul style="list-style-type: none"> • 700 mA @ 5V DC • 2.5 mA @ 24V DC • 3.56W
Relative humidity	5% to 95% noncondensing

1756-M02AE Servo Module Catalog Number

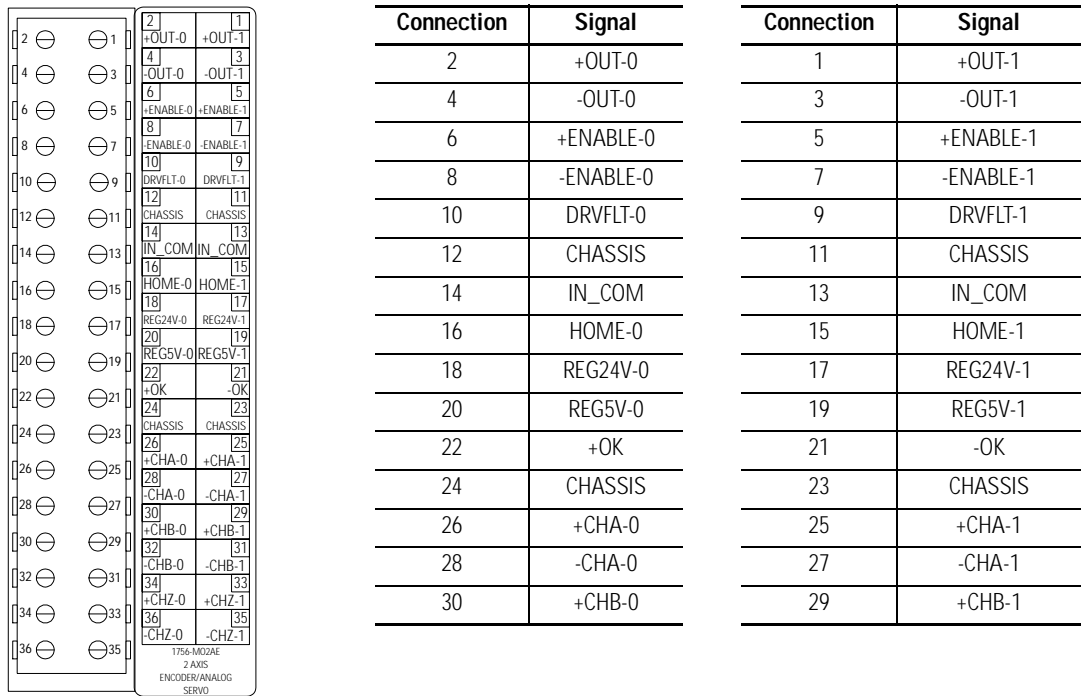
Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your servo module. For questions regarding product availability, contact your Allen-Bradley distributor.



Terminal Board Connection Data

The following section contains connection data for the 1756-TBxxH servo module terminal board. One terminal board is required for each 1756-M02AE servo module. The terminal board provides motor terminations so that motor performance can be controlled. It is removable and can be installed by opening the servo module door and sliding it into place.

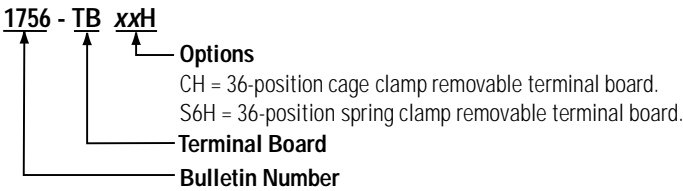
Figure 1.3
Servo Module Terminal Board Connections



Note: For information about 1394 and 2098 Ultra Family cables, refer to *Motion Control Accessories*.

1756-TBxxH Terminal Board Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your removable terminal board. For questions regarding product availability, contact your Allen-Bradley distributor.



1756-M08SE 8-Axis SERCOS Interface Servo Module



The 1756-M08SE ICP 8-Axis SERCOS interface module provides a fiber-optic link between the ControlLogix platform and servo drives. The communication link between the module and the drive(s) is via IEC 61491 and EN-61491 Serial Real-time Communication System (SERCOS) using a fiber-optic medium. This fiber-optic medium ensures reliable high-speed data transmission with excellent noise immunity, improved communication speed, and interconnect wiring between the drive and motion module.

The SERCOS interface module features:

- Drive and motor setup and configuration using RSLogix 5000 software.
- Real-time optical serial interface from ControlLogix to 1394 SERCOS interface systems and Ultra3000 drives for parameter updates.
- Support for eight servo drive axes for greater application flexibility.
- Support for up to 32 meters of plastic fiber-optic cable and 200 meters of glass fiber-optic cable for distributed, convenient drive support and an overall reduction of wiring.
- Support for high-resolution motor position feedback for superior performance.
- Support for single- and multi-turn absolute feedback for elimination of costly downtime and homing as a result of power outages.

1756-M08SE 8-Axis SERCOS Interface Module Specifications

The following section contains general, fiber-optic, communication, and environmental specifications for the 1756-M08SE ICP 8-Axis SERCOS interface module.

General Specifications

Specification	Description
Number of Axes	8 axes maximum
Module location	1756 ControlLogix chassis
Module keying	Electronic
Power dissipation	3.2W maximum
Backplane current	<ul style="list-style-type: none"> • 5.1V DC @ 600 mA • 24V DC @ 2.5 mA

Fiber-Optic Specifications

Specification	Description
Plastic Fiber Optic Specifications	
Transmission Range	1-32 meters
Core Diameter	980 μm ± 60 μm
Cladding Diameter	1,000 μm ± 60 μm
Cable Attenuation	140 dB/km @ 650 N-m (5,752.5 lb-in.)
Minimum Bend Radius	24.765 mm (0.975 in.)
Operating Temperature	-55° C to 85° C (-131° F to 185° F)
Connector	F-SMA standard screw-type connector
Glass Fiber Optic Specifications	
Transmission Range	1-200 meters
Core Diameter	200 μm ± 4 μm
Cladding Diameter	230 μm $\pm 0/-10$ μm
Cable Attenuation	6.0 dB/km @ 820 N-m (7,257 lb-in.)
Minimum Bend Radius	24.765 mm (0.975 in.)
Operating Temperature	-20° C to 85° C (68° F to 185° F)
Connector	F-SMA standard screw-type connector

Communication Specifications

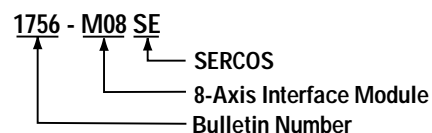
Specification	Description
SERCOS	
SERCOS Class	Class B (Position or Velocity)
Data Rate	4 Mbits per second
Operating cycle	1 ms for 1-4 axes 2 ms for 5-8 axes

Environmental Specifications

Specification	Description
Ambient Temperature	Operating temperature: 0° C to 60° C (32° F to 140° F) Storage temperature: -40° C to 85° C (-40° F to 185° F)
Relative Humidity	5 to 95% noncondensing
Vibration	2g @ 10-50 Hz
Shock	Operating: 30g peak acceleration, 11±1 ms pulse width Non-operating: 50g peak acceleration, 11±1 ms pulse width

1756-M08SE 8-Axis SERCOS Interface Module Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your interface module. For questions regarding product availability, contact your Allen-Bradley distributor.



Note: For information on fiber-optic cables, refer to *Motion Control Accessories*.

SoftLogix

The SoftLogix control platform is a means by which you can use your personal computer for industrial control applications. Many people do not consider the personal computer as reliable or fast as programmable logic controllers or rugged enough for the factory floor. However, today's advances in PC technology have made personal computers faster, more powerful, and more robust than ever.

SoftLogix for PC-based industrial control features:

- Low ownership costs, easy customization, straightforward data exchange, and speedy information processing.
- Replacement of proprietary control systems with open-architecture control that provides for connectivity to EtherNet™/IP, DeviceNet™, and ControlNet™.
- Ability to write your own custom commands through C programming, Visual Basic, and ActiveX.
- Ability to build your own control system with functionality to suit your specific application needs.

Note: The SoftLogix control platform is supported by the programming power of RSLogix 5000 software.

For more information regarding SoftLogix, refer to the *SoftLogix5800 Selection Guide* (publication 1789-SG001B-EN-P).

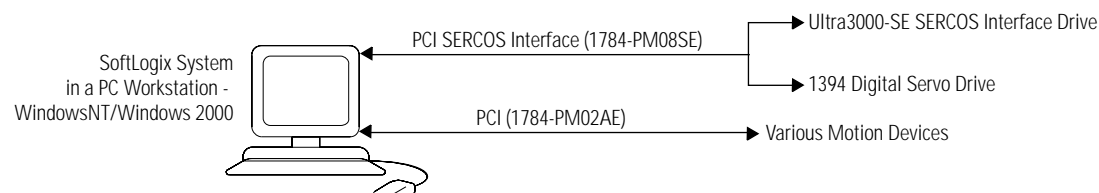
PC Requirements for SoftLogix

- Pentium II®-based IBM-compatible with at least 20 MB of hard disk space and at least 300 MHz.
- 128 MB of RAM (Minimum).
- Microsoft WindowsNT Service Pack 5 or greater, or Microsoft Windows 2000.
- CD-Rom drive (for installation).

System Overview

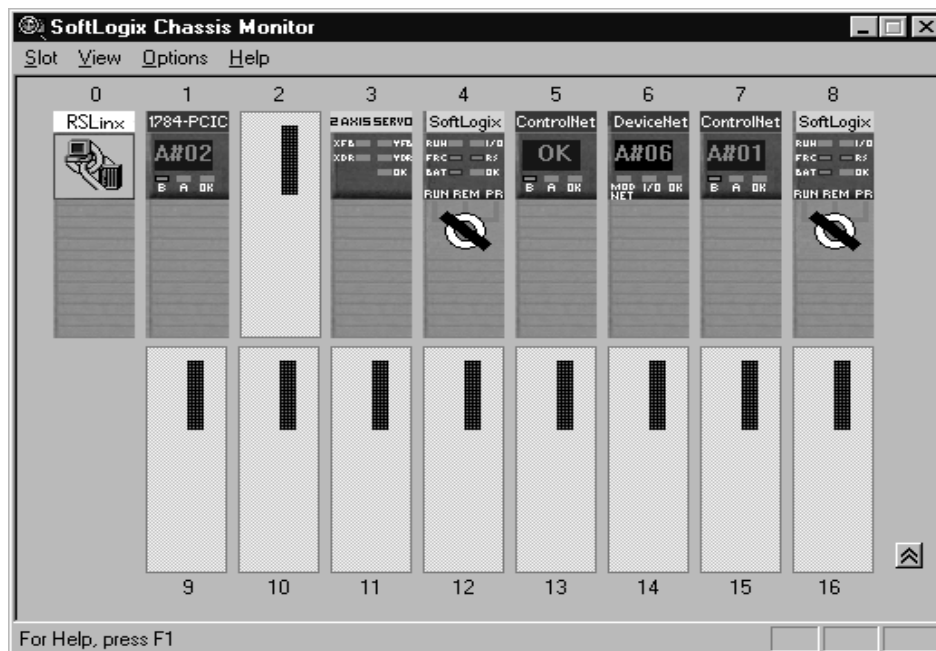
A SoftLogix system uses I/O in multiple platforms that is connected over multiple I/O links, as shown in the figure below.

Figure 1.4
SoftLogix System



The SoftLogix system uses a chassis monitor to display the devices in its system, as shown in the figure below. These devices all reside on a virtual backplane displayed on your computer. For more information about the SoftLogix chassis monitor, refer to the *SoftLogix5800 Selection Guide* (publication 1789-SG001B-EN-P).

Figure 1.5
SoftLogix Chassis Monitor



1784-PM02AE 2-Axis SoftLogix Servo Card



The 1784-PM02AE SoftLogix analog servo card is a two-axis servo module used with the SoftLogix5800™ controller.

Each SoftLogix analog servo card features:

- Connectivity and control of two drives.
- Fast position and velocity updates that allow the most advanced application solutions to be solved.
- UL listed.
- CSA listed.
- CE marked for all applicable directives.

1784-PM02AE 2-Axis SoftLogix Servo Card Specifications

The following section contains general, input, output, and environmental specifications for the 1784-PM02AE 2-Axis SoftLogix servo card.

General Specifications

Specification	Description
Number of axes per ControlLogix controller	32 axes maximum (i.e., 16 cards controlled by 1 ControlLogix controller)
Number of axes per module	2 axes maximum
Module Location	1756 ControlLogix chassis
Module Keying	Electronic
Power dissipation	5.5W maximum
Backplane current	<ul style="list-style-type: none"> • 700 mA @ 5V DC • 2.5 mA @ 24V DC • 3.56W

Input Specifications

Specification	Description
Encoder input	
Type	Incremental AB quadrature with marker
Mode	4X quadrature
Rate	4 MHz maximum
Electrical interface	Optically isolated 5V differential
Voltage range	
On state	3.4V to 5.0V
Off state	0V to 1.8V
Input impedance	531 Ohms differential
Registration inputs	
Type	Optically isolated, current sinking input
24V input voltage	+24V DC nominal
Maximum	26.4V
Minimum on	18.5V
Maximum off	3.5V
Input impedance	
24V input	1.2 kOhms
Response time	1 µs
(position latched)	

Output Specifications

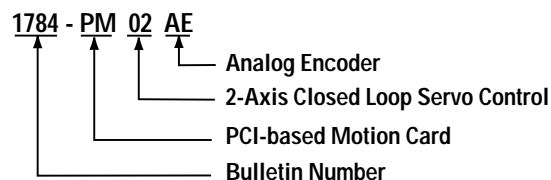
Specification	Description
Servo output	
Type	Analog voltage
Isolation	200 kOhms
Voltage range	±10V
Voltage resolution	16 bits
Load	5.6 kOhms resistive minimum
Maximum offset	25 mV
Gain error	±4%
OK and Enable Outputs	
Type	Solid-state isolated relay contacts
Operating voltage	+24V DC nominal (Class 2 source)
Maximum Operating current	26.4V 75 mA

Environmental Specifications

Specification	Description
Ambient Temperature	Operating temperature: 0° C to 40° C (32° F to 104° F) Storage temperature: -40° C to 85° C (-40° F to 185° F)
Relative Humidity	30 to 95%
Vibration	Operating: 1g, 5 Hz - 500 Hz Nonoperating: 2g, 5 Hz - 500 Hz
Shock	Operating: 10g Nonoperating: 30g

1784-PM02AE 2-Axis SoftLogix Servo Card Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your SoftLogix servo card. For questions regarding product availability, contact your Allen-Bradley distributor.



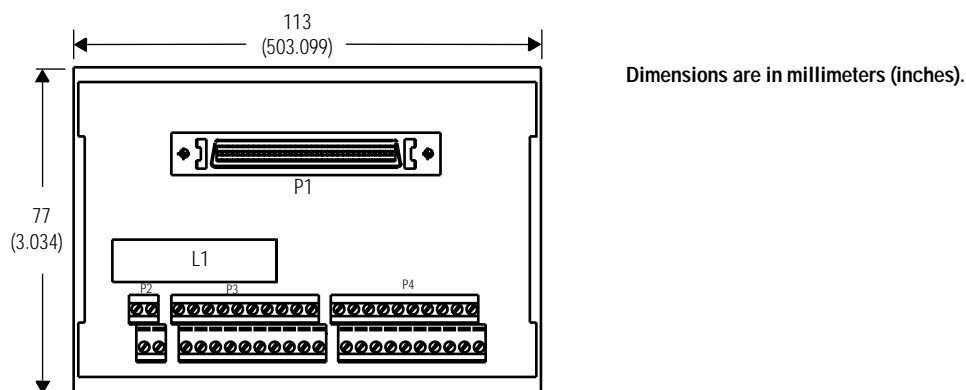
Termination Panel

The 1784-PM02AE SoftLogix termination panel is used in conjunction with the 1784-PM02AE 2-axis SoftLogix servo card to facilitate the wiring of drives and encoders for use with the card. Because the card is installed inside the PC computer cabinet, it would be difficult to access for wiring drives, encoders and other products. A termination panel, mounted separately from the card, allows for easier access to the two axis terminals.

The following section contains 1784-PM02AE termination panel dimensions and panel wiring connection data.

Panel Dimensions

Figure 1.6
1784-PM02AE-TPxx Termination Panel Dimensions

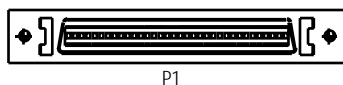


Note: For information on the 1784-PM02AE-TP0x termination cable, refer to the *SoftLogix5800 Selection Guide* (publication 1789-SG001B-EN-P).

Termination Panel Wiring Connection Data

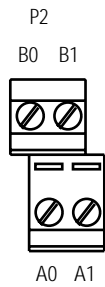
Servo Card Connection

Figure 1.7
1784-PM02AE-TP0x Servo Card Connection



Encoder Connections

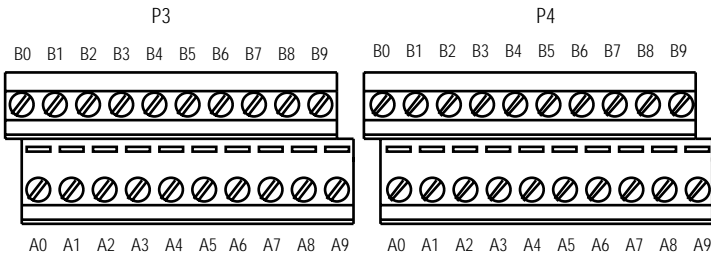
Figure 1.8
1784-PM02AE-TP0x Encoder Power Connections



Connection	Function	Connection	Function
A0	Encoder 0V	B0	Encoder Power
A1	Encoder 0V	B1	Encoder Power

Servo Card 2-Axis Wiring Connections

Figure 1.9
1784-PM02AE-TP0x Servo Card 2-Axis Wiring Connections

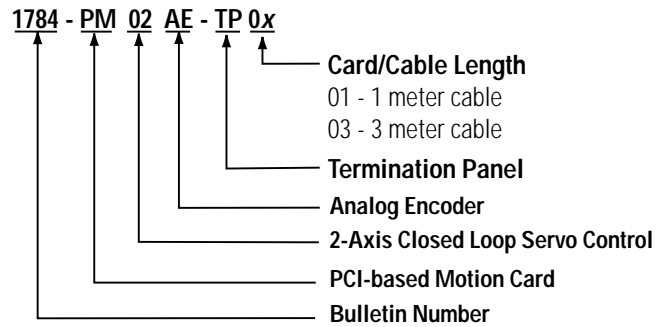


Connection	Function	Connection	Function
A0	DRVFLT	B0	+CHA
A1	Home Area	B1	-CHA
A2	Reg 1	B2	+CHB
A3	Reg 2	B3	-CHB
A4	OK	B4	+CHZ
A5	IN_COM	B5	-CHZ
A6	Enable+	B6	Screen
A7	Enable-	B7	+Out
A8	Encoder 0V	B8	-Out
A9	Chassis	B9	Encoder Pwr

Note: For information about 1394 and 2098 Ultra Family cables, refer to *Motion Control Accessories*.

1784-PM02AE Termination Panel Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your SoftLogix termination panel. For questions regarding product availability, contact your Allen-Bradley distributor.



Digital Servo Drives

Ultra3000™ Digital Servo Drives



The Ultra3000, Ultra3000i™, Ultra3000-SE™, Ultra3000-DN™, and Ultra3000X-DN™ make up a family of flexible, high-performance digital servo drives for a variety of motion control applications and architectures. The wide range of power platforms, connectivity options and functions makes the Ultra3000 digital servo drive family an attractive solution for a variety of machine control architectures including Logix, SLC, and third-party machine and motion control systems. In addition, the Ultra3000i indexing, Ultra3000-SE, Ultra3000-DN, Ultra3000X-DN indexing DeviceNet drives are positioning drives designed for applications requiring either simple or complex motion profiles.

Each standard Ultra3000 digital servo drive features:

- Optimized motor/drive combination for each application - operates a wide variety of brushless servo motors, including F-, H-, LD-, MP-, N-, W-, and Y-Series motors.
- Elimination of costly and time-consuming machine homing cycles - supports multi-turn absolute encoders or supplies external auxiliary power to maintain position during power loss.
- Maximized system performance with Ultraware software - increases productivity with the power of commissioning and diagnostic tools.
- Increased machine reliability - incorporates application-proven designs that have been tested individually and within overall architectures.
- 100-240V AC, single-phase input on 500W, 1 kW, 2 kW, and 3 kW models; three-phase input on 7.5 and 15 kW models.
- Simplified installation, enabling of SERCOS and DeviceNet communication options and drive configuration.
- Field programmable flash memory firmware storage for easy upgrades.
- Seven segment LED for status and error codes for convenient troubleshooting.
- Support for incremental, high resolution and multi-turn absolute feedback, including Stegmann Hiperface® and Sine/Cosine encoders.
- Automatic motor recognition capability with intelligent feedback devices, eliminating the need to manually configure motor parameters.
- Self-sensing commutation startup.
- Standard high-density D-Shell connectors for easy maintenance.
- Eight selectable general purpose inputs.

- Four selectable general purpose outputs and one relay output.
- Space vector modulation providing higher peak torques at higher speeds.
- CE compliance and UL listed to U.S. and Canadian safety standards.

Ultra3000 Architectures

The Ultra3000 digital servo drive family offers simple integration into multiple Allen-Bradley machine control architectures.

Drive Type	Command Interface
Digital drive with DeviceNet	DeviceNet communication interface
SERCOS interface drive	Fiber-optic SERCOS ring
Indexing and Indexing DeviceNet drives	No command interface required (point-to-point positioning controlled through binary I/O)
Analog drive	Control interface

Ultra3000i Indexing Digital Servo Drives

In addition to the standard Ultra3000 features, the Ultra3000i indexing drive features:

- 64 configurable index profiles for absolute, incremental, registration-type positioning (stored in non-volatile memory), and jog.
- Menu-driven parameter entry allowing up to 64 stored motion profiles, selectable via I/O or linked via software sequencing.
- Ability to blend indexes without coming to a complete stop.
- Built-in homing routines.
- Ability to stop an index via digital inputs or serial inputs.
- Jog motion profiles.
- Eight preset positions for simple replacement of pneumatic cylinders.

The Ultra3000i indexing drive can execute up to 64 different trapezoidal position moves initiated by digital I/O and the sequencing of unlimited indexes through the use of the host command language. The benefit of indexing is that it allows the drive to be cost-effective, high performing and flexible in applications where past electronic motion control systems were not. The Ultra3000i simplifies and helps reduce costs by eliminating the need for the command source typically provided by motion controllers, stepper controllers and PLC servo and stepper cards.

The Ultra3000i indexing drive supports the following four types of index moves:

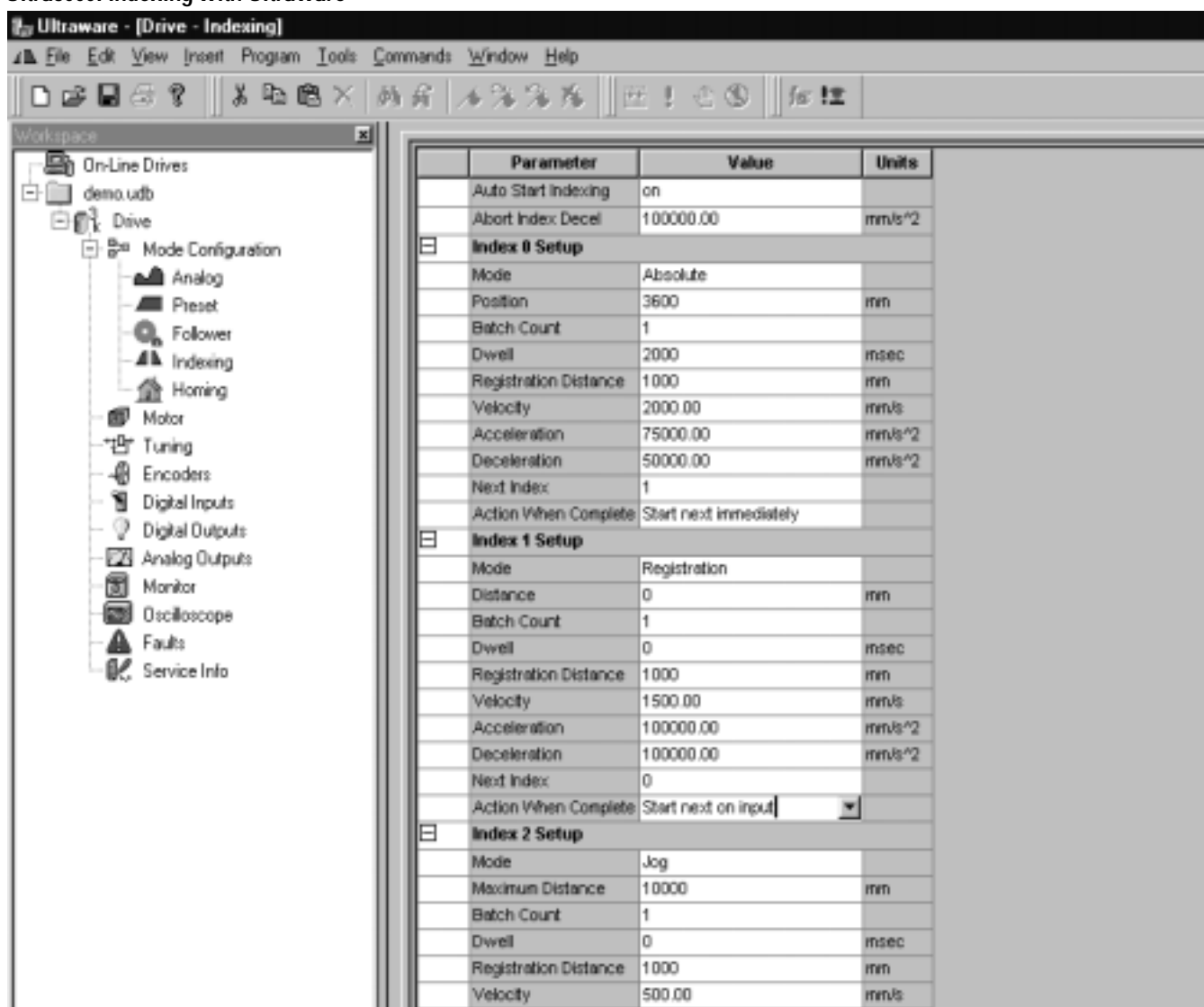
- Incremental - distance move executed relative to current position
- Registration - distance move executed relative to the registration sensor digital input
- Absolute - position move executed in reference to the home position
- Jog - input level-sensitive move executed while input remains high or maximum distance defined is achieved

Ultra3000i Set-up and Homing with Ultraware

The Ultra3000i indexing drive provides maximum flexibility by allowing you to define the following parameters for each individual index profile:

- Indexing Mode
- Distance (Position)
- Batch Count
- Action When Complete
- Registration Distance
- Velocity
- Acceleration
- Deceleration
- Dwell Time
- Next Index

Figure 2.1
Ultra3000i Indexing with Ultraware

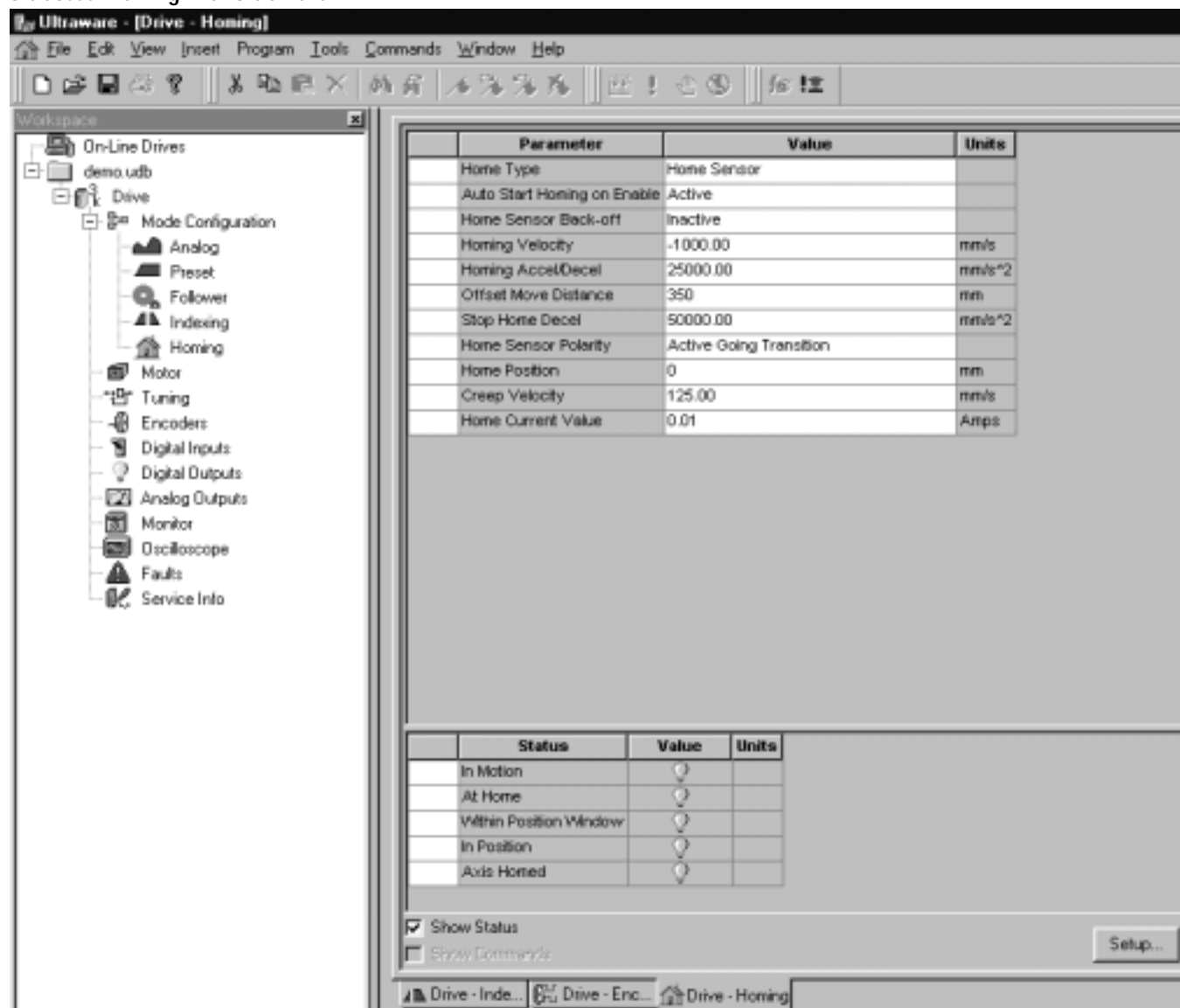


Note: Menu-driven parameter entry in Ultraware makes set-up much easier. The Ultra3000i indexing drive allows software sequencing of index profiles. This flexibility allows you to create powerful motion profiles to meet the requirements of your application.

The Ultra3000i also offers a user-defined home routine, which allows you to home the axis without the aid of any other device. Using Ultraware, you can select one of the following different home routines to match your motion application:

- Home-to-sensor-to-marker
- Home-to-marker
- Home-to-sensor
- Home-to-current limit value
- Home-to-current limit value-to-marker

Figure 2.2
Ultra3000i Homing with Ultraware

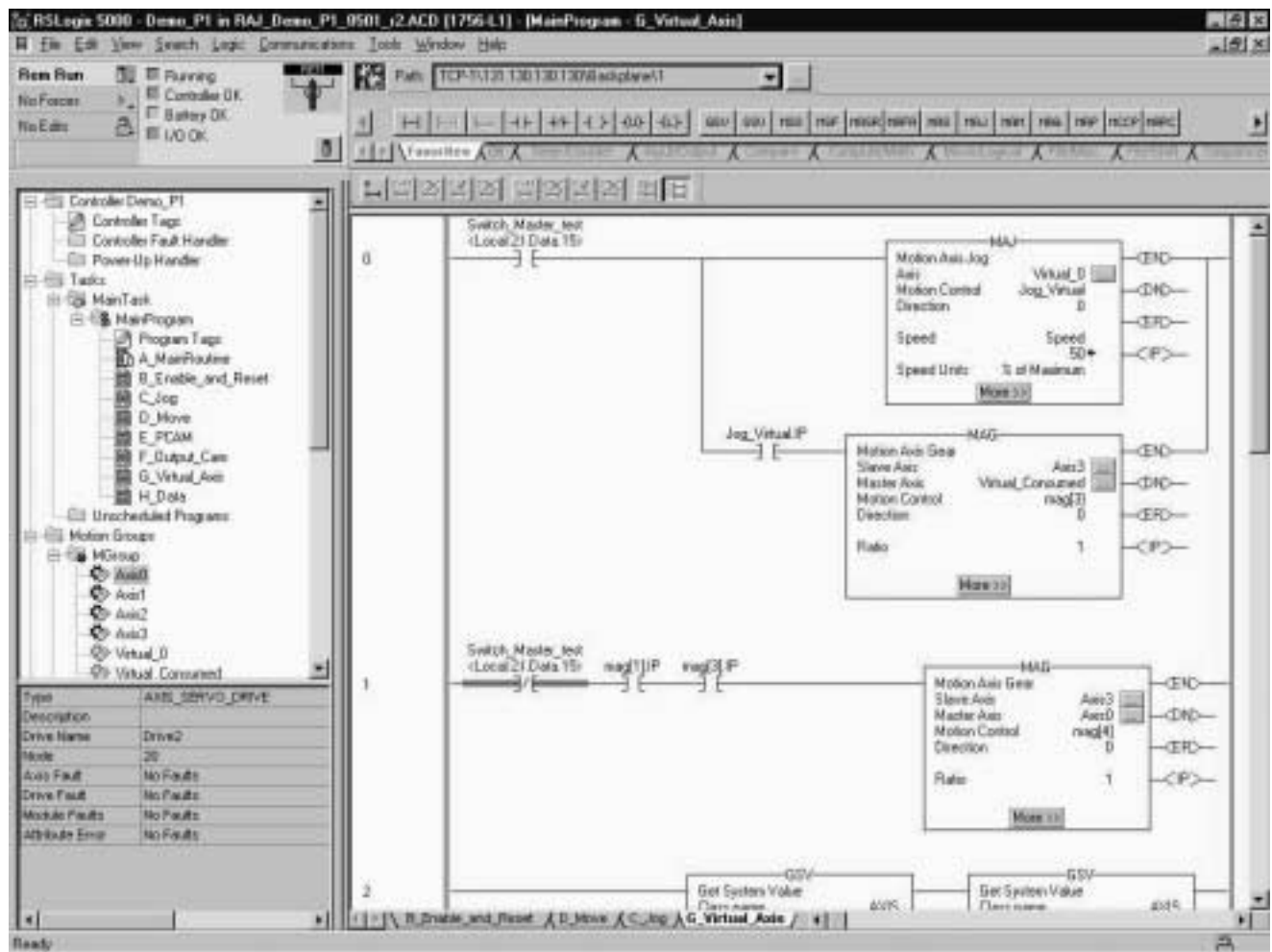


Ultra3000-SE Digital Servo Drives with SERCOS Interface

In addition to the standard features, the Ultra3000-SE SERCOS interface drives features:

- Simplified integration in Logix architecture.
- Single fiber-optic connection between drive and Logix controller.
- Single-point drive commissioning through RSLogix.

Figure 2.3
Ultra3000-SE with RSLogix 5000 Programming Software



Ultra3000-DN Digital Servo Drives with DeviceNet Interface

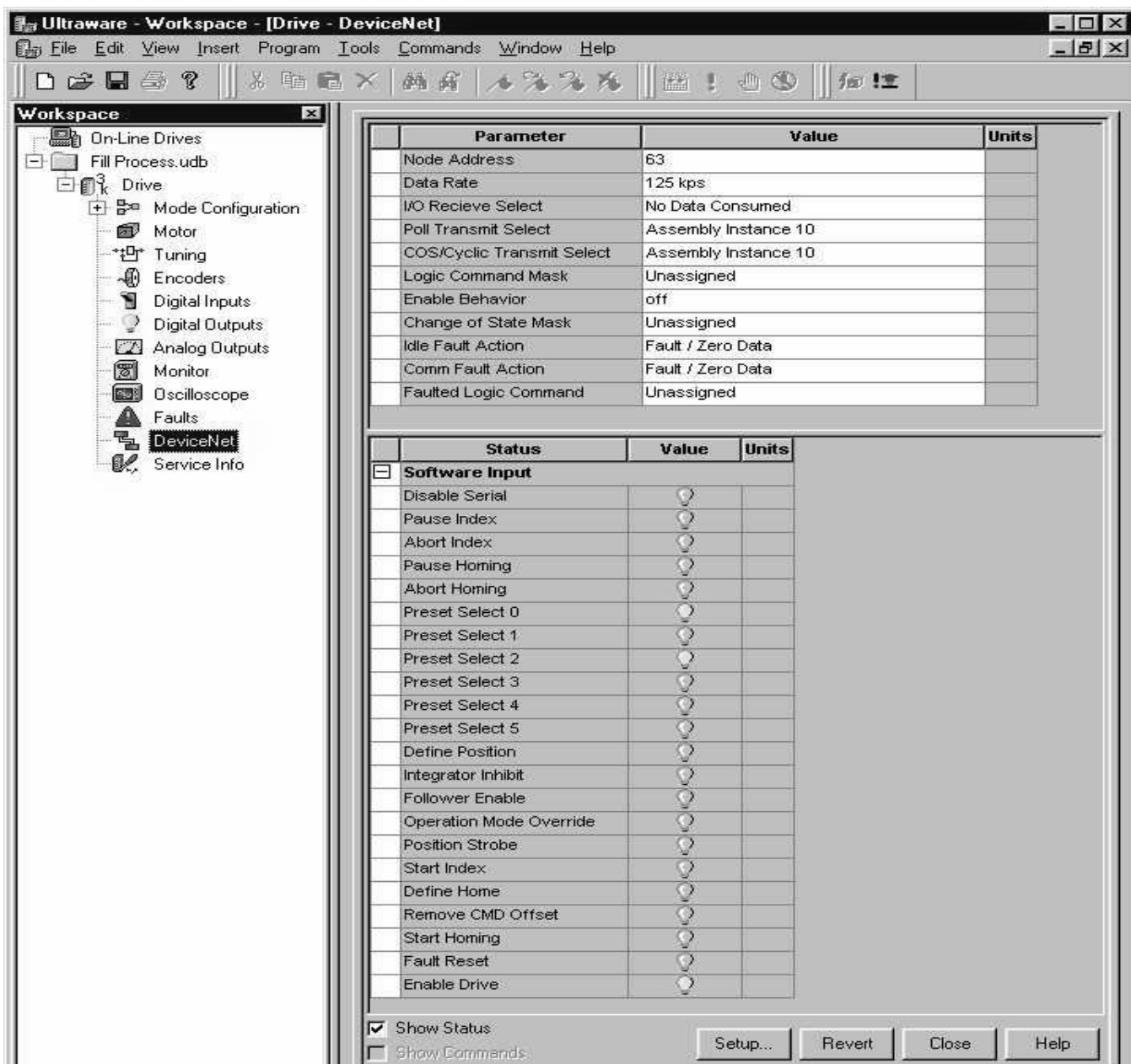
In addition to the standard Ultra3000 features, the Ultra3000-DN DeviceNet drive features:

- Communication over one industry-standard network, providing common end-user solutions to application challenges.
- Diagnostics that reduce downtime by providing accurate troubleshooting and failure warnings.
- An interface through a single cable from a programmable controller directly to “smart” devices such as sensors, push buttons, motor starters, simple operator interfaces and drives.
- Ability to be controlled by any compatible control, such as a PLC[®]
- Drive configuration through the remote downloading of parameters.
- Single deviceNet connection that eliminates control-to-drive wiring and reduces startup and installation costs.
- Ability to easily modify parameters over the network.
- Ability to manage network traffic with change-of-state (COS), cyclic, or polled data options.

In addition to the DeviceNet functionality mentioned above, the Ultra3000X-DN indexing DeviceNet drive features:

- 64 indexes that can be selected for an economical solution to applications that require simple position control.
- Flexibility of indexes that can be absolute positions, incremental distances, and even sensor-based motions.
- Ability to link multiple indexes for more versatile position control.

Figure 2.4
Ultra3000-DN and Ultra3000X-DN with Ultraware



Ultra3000 Digital Servo Drive System Overview

Figure 2.5
Ultra3000 Digital Servo Drive System Overview

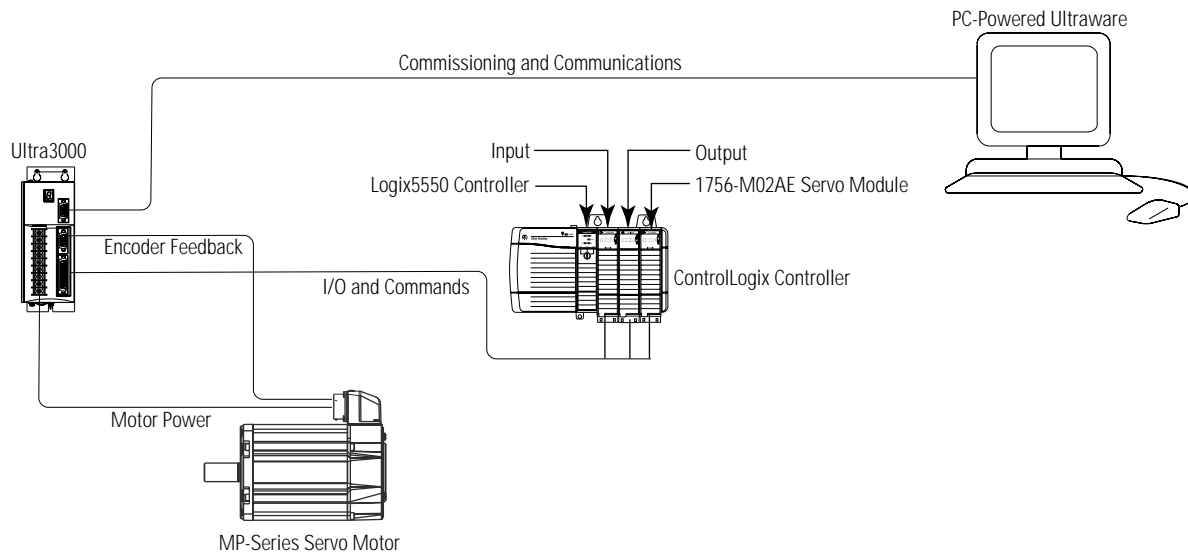


Figure 2.6
Ultra3000 (SERCOS interface) Digital Servo Drive System Overview

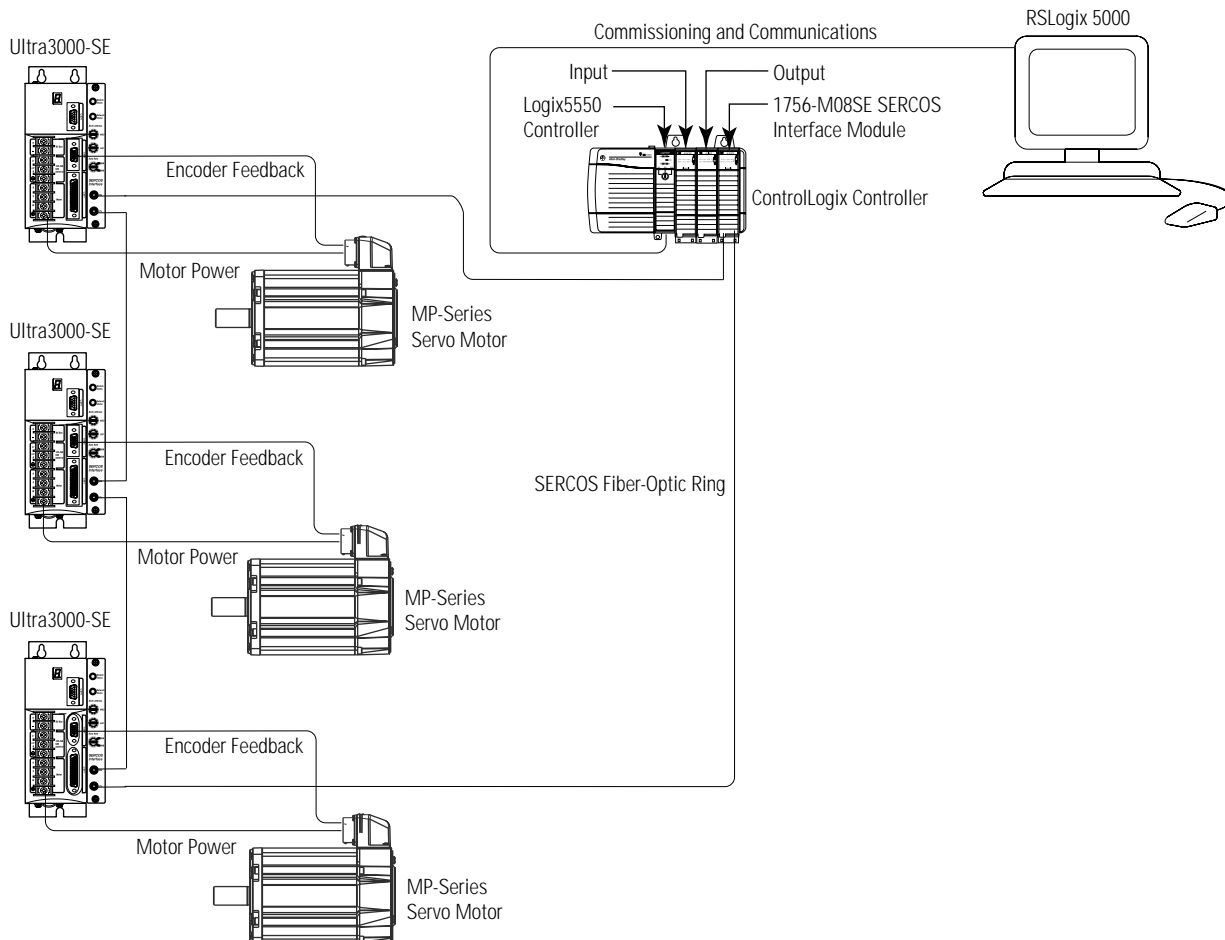
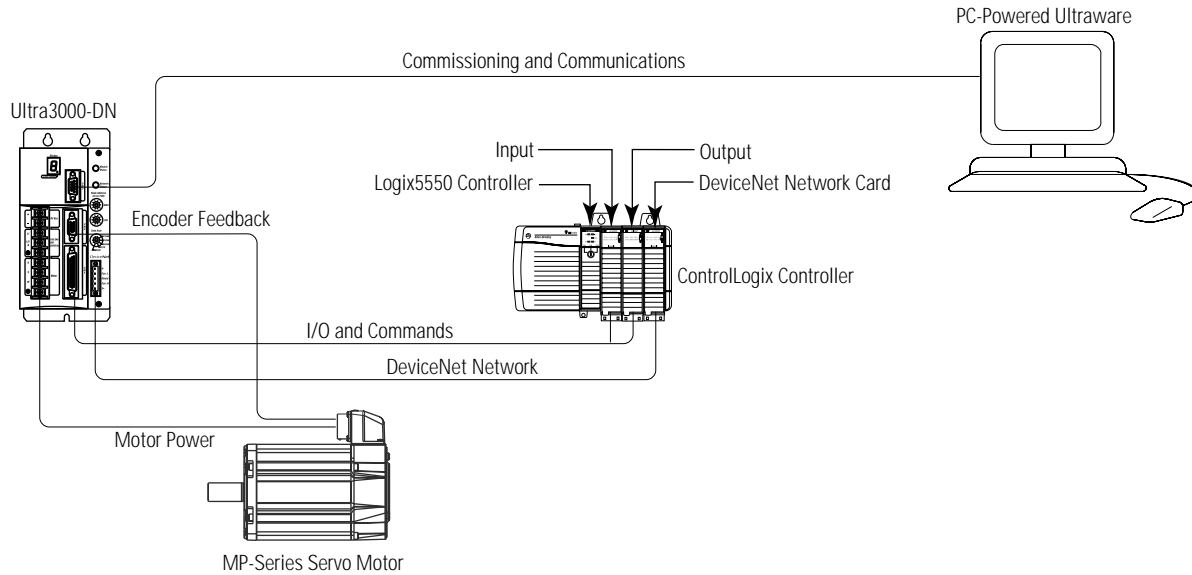


Figure 2.7
Ultra3000 (DeviceNet) Digital Servo Drive System Overview



Ultra3000 Power Ratings

The following table contains the power ratings for all of the Ultra3000 digital servo drives.

Model	Power Rating
2098-DSD-005x-xx	500W
2098-DSD-010x-xx	1 kW
2098-DSD-020x-xx	2 kW
2098-DSD-030xxx-xx	3 kW
2098-DSD-075x-xx	7.5 kW
2098-DSD-150xxx-xx	15 kW

Ultra3000 Digital Servo Drive Specifications

The following section contains general, physical/environmental, power input, power dissipation, controller, inputs/outputs, operating modes command sources, communication, feedback, serial communication port and connector specifications for the Ultra3000 digital servo drives. These specifications also apply to Ultra3000 indexing drives, SERCOS interface drives, DeviceNet drives, and indexing DeviceNet drives.

General Specifications

Drives 2098-DSD-	Continuous Output Current amps	Peak Output Current amps	Continuous Output Power kW		External Shunt		Internal Shunt ⁶		Energy Absorption Capability Joules	
			115V AC	230V AC	Continuous Power kW	Peak Power kW	Continuous Power W	Peak Power kW	115V AC	230V AC
005 005X ¹ 005-SE ² 005X-DN ³ 005-DN ⁴	2.5	7.5	0.25	0.5	0.3 ⁵	4 ⁵	—	—	125	51
010 010X ¹ 010-SE ² 010X-DN ³ 010-DN ⁴	5	15	0.5	1			—	—		
020 020X ¹ 020-SE ² 020X-DN ³ 020-DN ⁴	10	30	1	2			—	—		
030 030X ¹ 030-SE ² 030X-DN ³ 030-DN ⁴	15		1.5	3	2.4 ⁵	6 ⁵	50	4.5	203	96
075 075X ¹ 075-SE ² 075X-DN ³ 075-DN ⁴	35	75	3.75	7.5	4 ⁵	10 ⁵		10	321	151
150 150X ¹ 150-SE ² 150X-DN ³ 150-DN ⁴	65	150	7.5	15	8 ⁵	19 ⁵	180	18	563	265

¹ The X indicates the indexing version of the drive.

² The SE indicates the SERCOS interface version of the drive.

³ The X-DN indicates the indexing DeviceNet version of the drive.

⁴ The DN indicates the DeviceNet version of the drive.

⁵ Rating indicates use of 2090-UCSR-A300 shunt resistor kit.

⁶ Internal shunts are not available on 500W, 1 kW, and 2 kW Ultra3000 digital servo drives.

Physical and Environmental Specifications

Specification	Description
Weight	2098-DSD-005, -005X ¹ - 1.77 kg (3.9 lb) 2098-DSD-010, -010X ¹ - 2.06 kg (4.55 lb) 2098-DSD-020, -020X ¹ - 2.05 kg (4.51 lb) 2098-DSD-005-SE ² , -005-DN ³ , -005X-DN ⁴ - 1.84 kg (4.1 lb) 2098-DSD-010-SE ² , -010-DN ³ , -010X-DN ⁴ - 2.19 kg (4.8 lb) 2098-DSD-020-SE ² , -020-DN ³ , -020X-DN ⁴ - 2.14 kg (4.7 lb) 2098-DSD-030, -030X ¹ , -030-SE ² , -030-DN ³ , -030X-DN ⁴ - 6.17 kg (13.6 lb) 2098-DSD-075, -075X ¹ , -075-SE ² , -075-DN ³ , -075X-DN ⁴ - 9.34 kg (20.6 lb) 2098-DSD-150, -150X ¹ , -150-SE ² , -150-DN ³ , -150X-DN ⁴ - 14.05 kg (30.98 lb)
Ambient Temperature	Storage: -40° C to 70° C (-104° F to 158° F) Operation: 0° C to 55° C (32° F to 131° F)
Relative Humidity	5-90% noncondensing
Altitude	1500 m (4921.5 ft) - Derate 3% per 300 m (984.3 ft) above 1500 m (4,921.5 ft)
Vibration	5-2000 Hz @ 2.5g peak, 0.0006 mm (0.015 in.) maximum displacement
Shock	15g, 11 ms half-sine

¹ The X indicates the indexing version of the drive.

² The SE indicates the SERCOS interface version of the drive.

³ The DN indicates the DeviceNet version of the drive.

⁴ The X-DN indicates the indexing DeviceNet version of the drive.

Power Input Specifications

Drives 2098-DSD-	Main AC Input Current		Auxiliary AC Input Current ⁶				Input Voltage ⁵	Input Frequency	I/O Voltage V DC
	Nominal Input Current amps (RMS)	Maximum Inrush Current (230V AC Input) amps	Nominal Input Current		Maximum Inrush Current				
			115V AC	230V AC	115V AC	230V AC			
005, 005X ¹ , 005-SE ² 005-DN ³ , 005X-DN ⁴	5A _{rms}	100A _{rms} (0-peak)	NA	NA	NA	NA	100-240V _{rms} AC (Single Phase)	47-63 Hz	External 12-24V DC required for digital I/O
010, 010X ¹ , 010-SE ² 010-DN ³ , 010X-DN ⁴	9A _{rms}		NA	NA	NA	NA			
020, 020X ¹ , 020-SE ² 020-DN ³ , 020X-DN ⁴	18A _{rms}		NA	NA	NA	NA			
030, 030X ¹ , 030-SE ² 030-DN ³ , 030X-DN ⁴	28A _{rms}	50A _{rms} (0-peak)	1A _{rms}	0.5A _{rms}	47A _{rms} (0-peak)	95A _{rms} (0-peak)	100-240V _{rms} AC (Three Phase)		NA ⁷
075, 075X ¹ , 075-SE ² 075-DN ³ , 075X-DN ⁴	30A _{rms}	50A _{rms} (0-peak)							NA ⁷
150, 150X ¹ , 150-SE ² 150-DN ³ , 150X-DN ⁴	46A _{rms}	68A _{rms} (0-peak)							NA ⁷

¹ The X indicates the indexing version of the drive.

² The SE indicates the SERCOS interface version of the drive.

³ The DN indicates the DeviceNet version of the drive.

⁴ The X-DN indicates the indexing DeviceNet version of the drive.

⁵ Specification is for nominal voltage. The absolute limits are ±10%, or 88-265V_{rms}.

⁶ There is no auxiliary AC input current on 500W, 1 kW, and 2 kW Ultra3000 digital servo drives.

⁷ This external 24V DC power supply is only required for 500W, 1 kW and 2 kW drives. For 3, 7.5 and 15 kW drives, power is internally supplied.

Power Dissipation Specifications

Drives 2098-DSD-	Power Dissipation watts
005, 005X ¹ , 005-SE ² , 005-DN ³ , 005X-DN ⁴	48 + dissipative shunt
010, 010X ¹ , 010-SE ² , 010-DN ³ , 010X-DN ⁴	48 + dissipative shunt
020, 020X ¹ , 020-SE ² , 020-DN ³ , 020X-DN ⁴	50 + dissipative shunt
030, 030X ¹ , 030-SE ² , 030-DN ³ , 030X-DN ⁴	150 + dissipative shunt
075, 075X ¹ , 075-SE ² , 075-DN ³ , 075X-DN ⁴	300 + dissipative shunt
150, 150X ¹ , 150-SE ² , 150-DN ³ , 150X-DN ⁴	500 + dissipative shunt

¹ The X indicates the indexing version of the drive.

² The SE indicates the SERCOS interface version of the drive.

³ The DN indicates the DeviceNet version of the drive.

⁴ The X-DN indicates the indexing DeviceNet version of the drive.

Controller Specifications

Specification	Description
Commutation	3-Phase Sinusoidal, Space Vector Modulated (SVM)
Current Regulator	Digital PI - 125 μ s update rate
Velocity Regulator	Digital PID - 250 μ s update rate
Position Regulator	Digital PID with feed-forward - 1 ms update rate
PWM	8 kHz, space vector modulation
Velocity Loop Bandwidth (maximum)	300 Hz

Inputs/Outputs Specifications

Specification	Description
Digital Inputs	8 optically isolated, 12-24V, active high, current sinking
Digital Outputs	4 optically isolated, 12-24V, active high, current sourcing
Relay Output	One normally open relay, 30V DC maximum voltage, 1 ampere maximum current
I/O Response	100 μ s
Digital I/O Firmware Scan Period	1 ms
Analog Inputs COMMAND ILIMIT	14-bit A/D, ± 10 V 10-bit A/D, 0 to 10V
Analog Output	0 to +10V, 8 bits, 2 mA maximum

Operating Modes Command Sources

Specification	Description
Analog velocity/current position mode	±10V
Presets, position, velocity, current, electronic gearing	8 presets, binary selection by digital inputs or serial commands, velocity, current, position, or electronic gearing
Step and direction, step up/step down	2.5 MHz maximum frequency, differential or single-ended input
Master encoder following	2.5 MHz maximum line frequency, differential or single-ended input
Digital serial commands	Via serial port and 7-bit ASCII protocol
Indexing ¹	64 configurable indices, selectable by digital inputs or serial commands Blended moves Jogging and Stop indices via digital input or serial command
Positioning Types ¹	Absolute, Incremental, Registration
Home Routines ¹	Home to sensor, Home to marker, Home to sensor/marker, or Home to current limit value

¹ Specification only applies to Ultra3000i indexing drives and Ultra3000X-DN indexing DeviceNet drives.

Serial Communications Specifications

Specification	Description
Serial	1 RS-232/RS-422/RS-485 Port
Baud Rates	1200, 2400, 4800, 9600, 19200, and 38400 (Default) baud
Frame Format	7-bit Data, Even Parity, One Stop
	7-bit Data, Odd Parity, One Stop
	8-bit Data, No Parity, One Stop
	8-bit Data, Even Parity, One Stop
	8-bit Data, Odd Parity, One Stop

Ultra3000-SE SERCOS Communication Specifications

Specification	Description
Baud Rates	2 and 4
Node Addresses	01-99

Ultra3000-DN DeviceNet Communication Specifications

Specification	Description
Power Consumption from Network	60 mA
Baud Rates	125, 250, and 5000
Node Addresses	00-63
Messaging Capabilities	Explicit, Polled I/O, Change of State, and Cyclic Messaging

Feedback Specifications

Motor Feedback		Auxiliary Feedback	
Specification	Description	Specification	Description
Encoder Types	Incremental, Sine/Cosine, Intelligent, and Absolute	Input Modes	A quad B, Step/Direction, CW/CCW
Maximum Input Frequency	2.5 MHz (TTL Input) per channel	Maximum Input Frequency	2.5 MHz
	100 kHz (Sine/Cosine Input)	Input Types	Differential, single-ended, open collector ¹
Commutation Feedback	Hall Sensor or None		

¹ Differential input types are recommended.

Serial Communication Port Specifications

Communication Type	Port Type	Baud Rate
Serial	RS-232, RS-422, RS-485 ¹	1,200-38,400

¹ Requires an RS-232 to four-wire RS-485 interface converter.

Connectors Specifications

Connector	Specification	Description
CN1	User Input/Output	44-pin high-density D-shell
CN2	Motor Feedback Connector	15-pin high-density D-shell
CN3	Serial Port Connector	9-pin standard D-shell

Ultra3000 Digital Servo Drive Dimensions

The following section contains dimensions for the 500W, 1 kW, 2 kW, 3 kW, 7.5 kW, and 15 kW Ultra3000 digital servo drives.

Figure 2.8
Ultra3000 and Ultra3000i 500W Dimensions (2098-DSD-005x-xx)

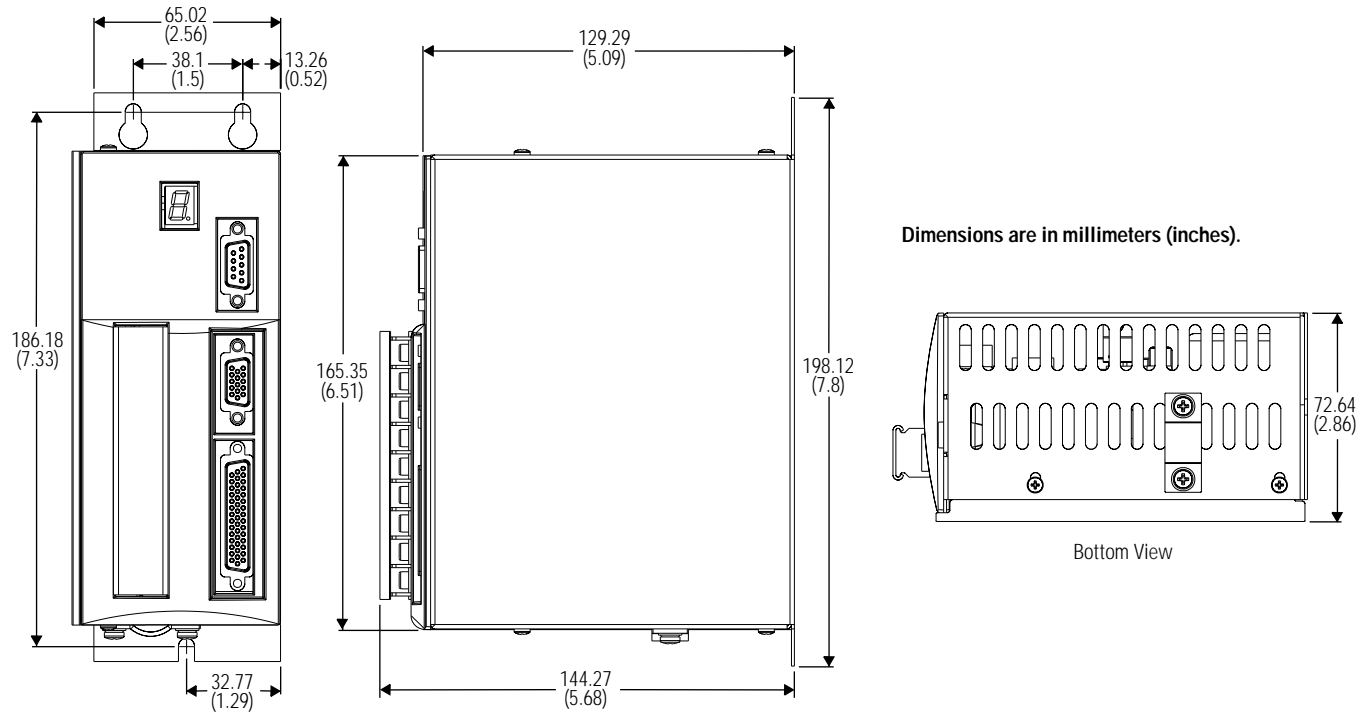


Figure 2.9
Ultra3000 and Ultra3000i (1 and 2 kW) Dimensions (2098-DSD-0xxx-x)

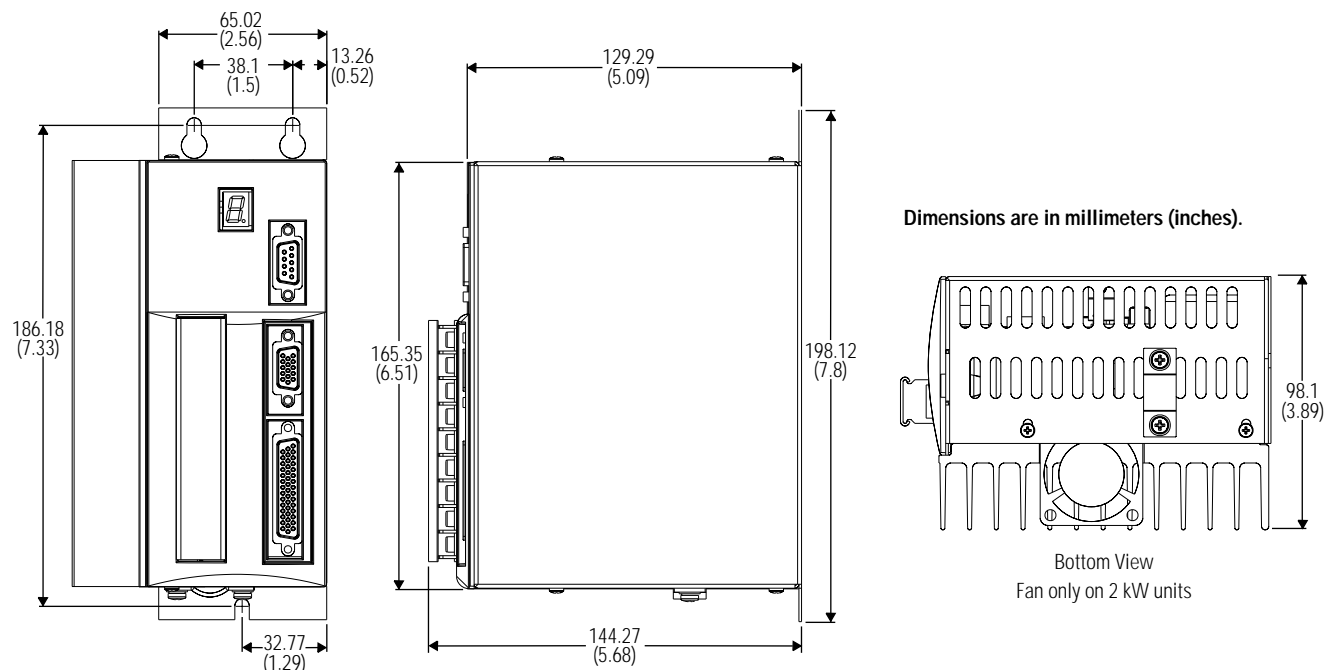
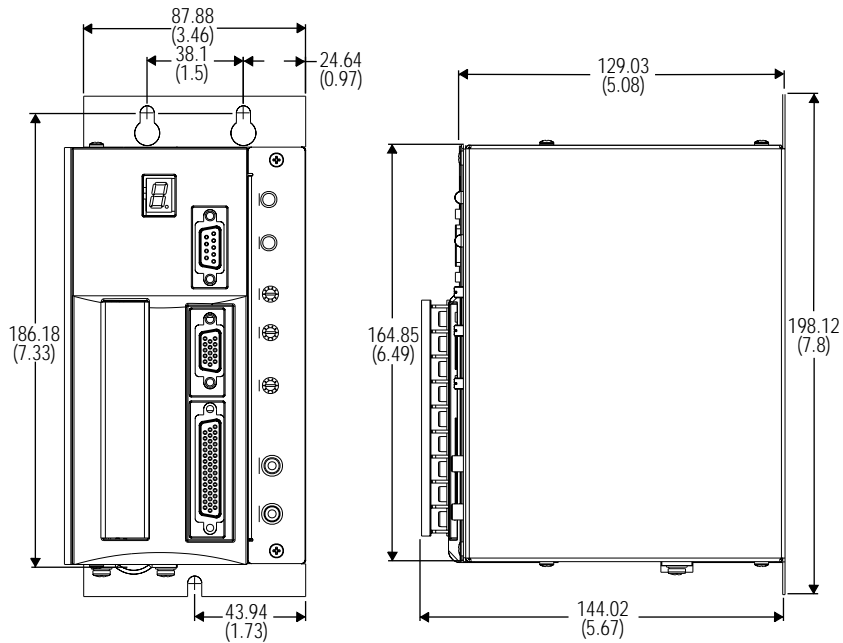


Figure 2.10
Ultra3000-SE, -DN, and -X-DN (500W) Dimensions (2098-DSD-005x-xx)



Dimensions are in millimeters (inches).

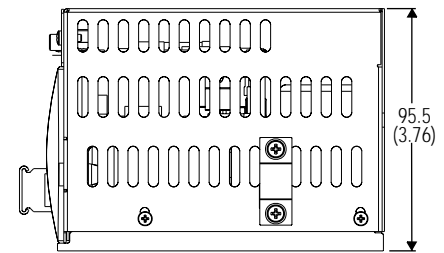
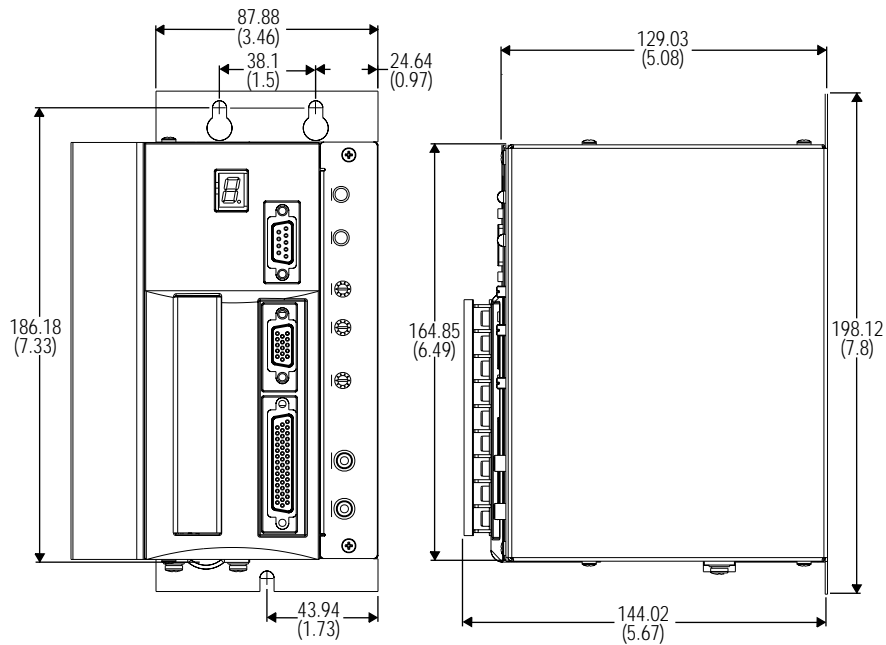
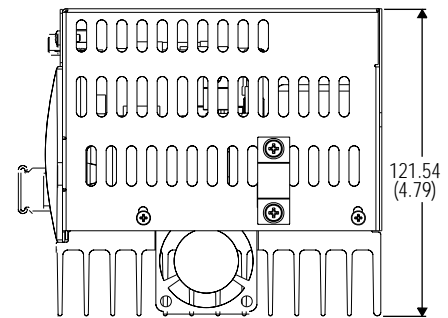


Figure 2.11
Ultra3000-SE, -DN, and -X-DN (1 and 2 kW) Dimensions (2098-DSD-0xxx-xx)



Dimensions are in millimeters (inches).



Bottom View
 Fan on 2 kW units only

Figure 2.12
Ultra3000, -i, -SE, -DN, -X-DN (3 kW) Dimensions (2098-DSD-0xxxxxx-xx)

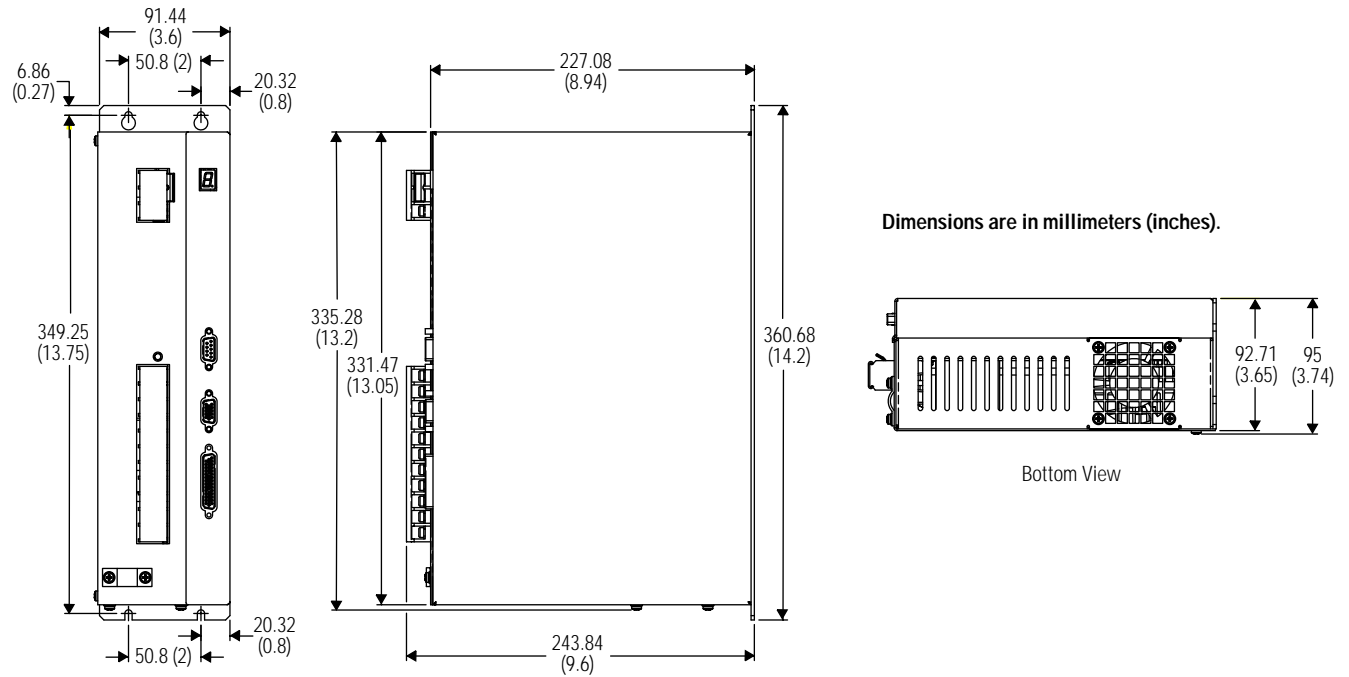


Figure 2.13
Ultra3000, -i, -SE, -DN, -X-DN, (7.5 and 15 kW) Dimensions (2098-DSD-0xxxxxx-xx)

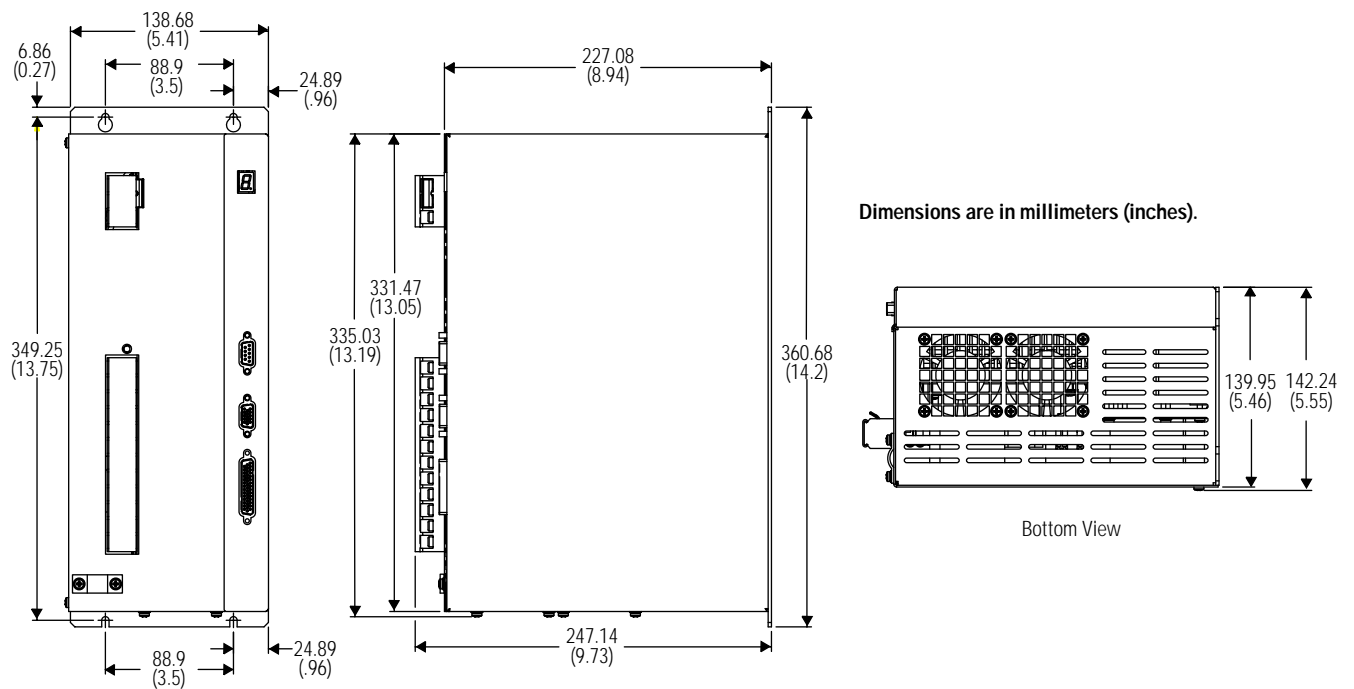
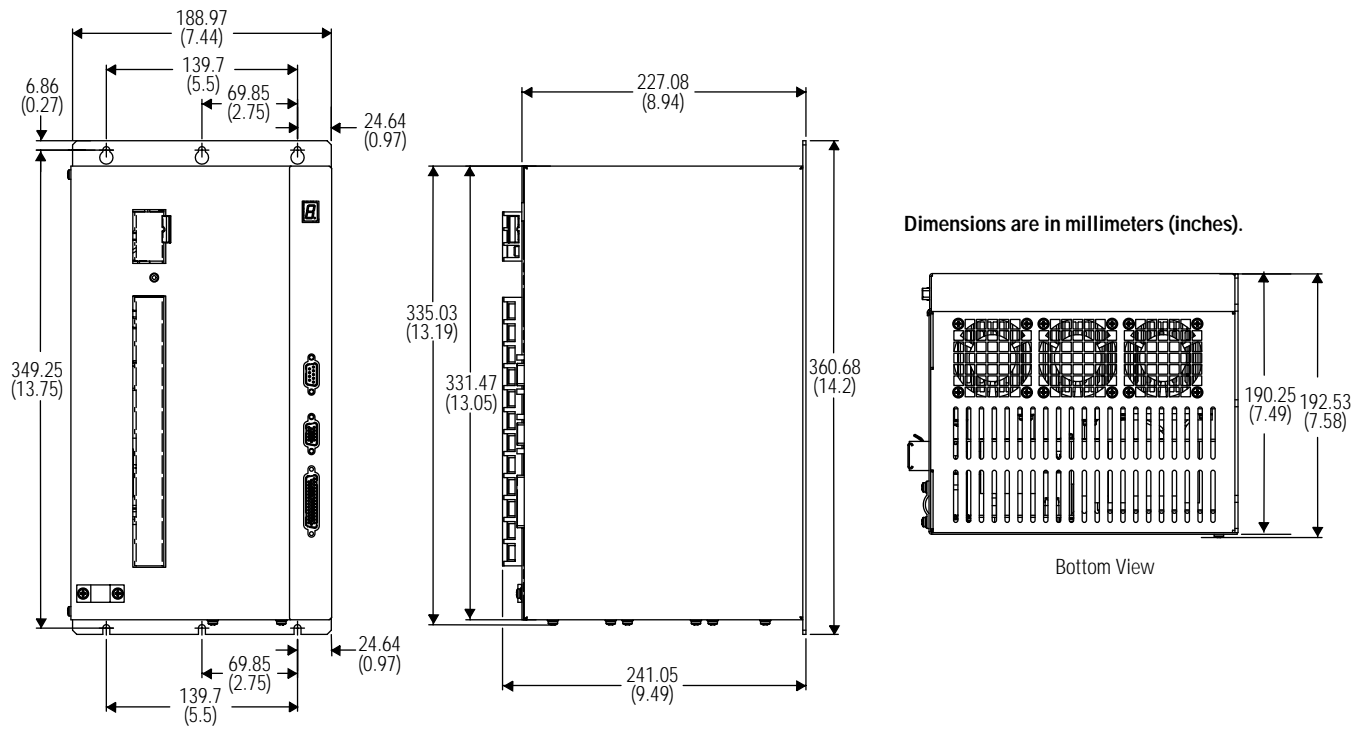


Figure 2.14
Ultra3000, -i, -SE, -DN, -X-DN (15 kW) Dimensions (2098-DSD-0xxxxxx-xx)



Ultra3000 and Ultra3000i Connector Data

The following section provides the external connections, and the I/O, motor encoder, serial port, and terminal block connector pins and signals for the Ultra3000 and Ultra3000i indexing digital servo drives.

Figure 2.15

Ultra3000 and Ultra3000i External Connections (500W, 1 kW, and 2 kW) (2098-DSD-0xxx)

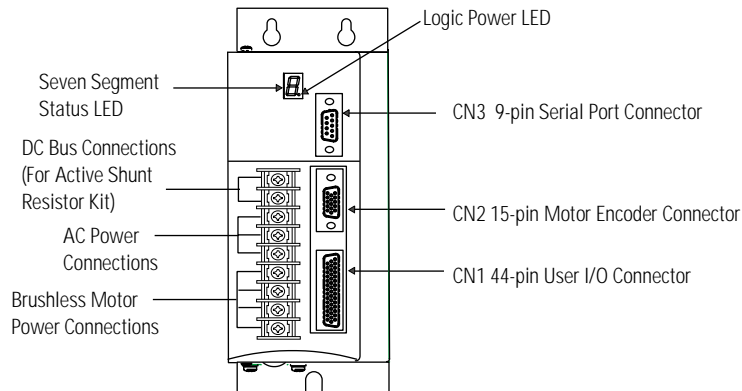


Figure 2.16

Ultra3000 and Ultra3000i External Connections (3 kW) (2098-DSD-0xxxxx)

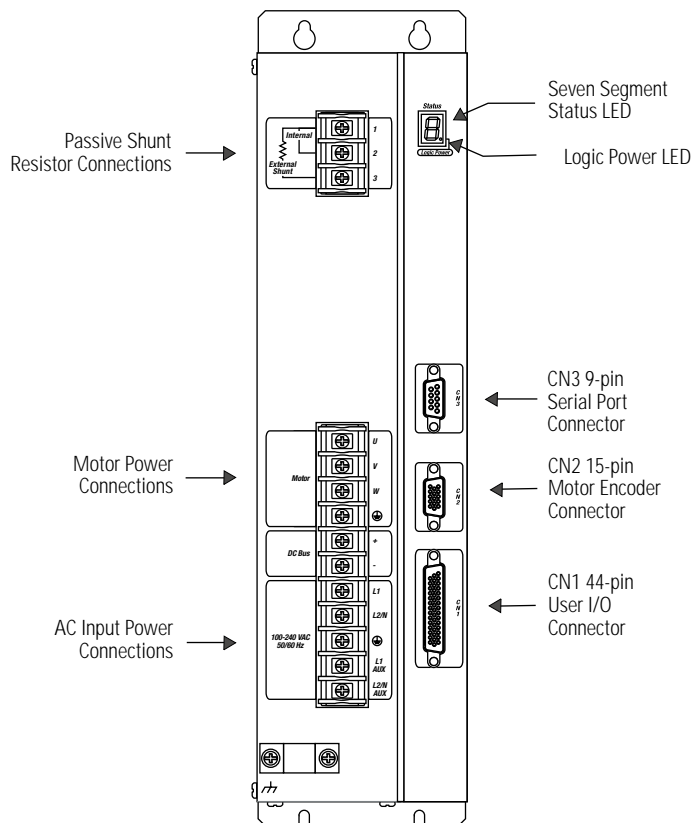
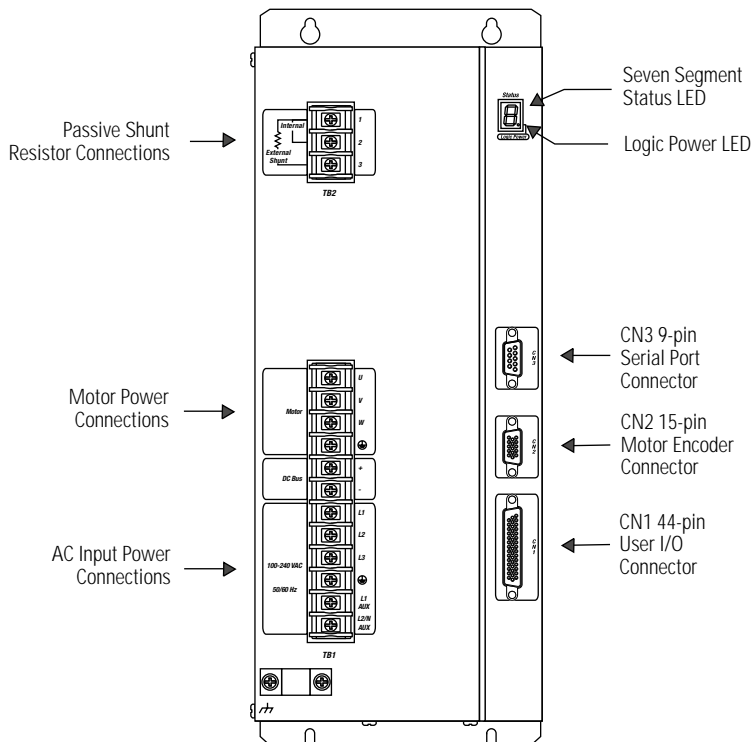


Figure 2.17
Ultra3000 and Ultra3000i External Connections (7.5 and 15 kW) (2098-DSD-0xxxxx)



I/O Connector Pins and Signals (CN1)

Pin	Description	Signal
1	Auxiliary Encoder Power Out +5V DC	EPWR
2	Common	ECOM
3	Auxiliary Logic Power In +5V	AUXPWR
4	Auxiliary Encoder Ch A+	AX+
5	Auxiliary Encoder Ch A+	AX-
6	Auxiliary Encoder Ch B+	BX+
7	Auxiliary Encoder CH B-	BX-
8	Auxiliary Encoder Ch I+	IX+
9	Auxiliary Encoder Ch I-	IX-
10	Unbuffered Motor Encoder Ch A+	AM+
11	Unbuffered Motor Encoder Ch A-	AM-
12	Unbuffered Motor Encoder Ch B+	BM+
13	Unbuffered Motor Encoder Ch B-	BM-
14	Unbuffered Motor Encoder Ch I+	IM+
15	Unbuffered Motor Encoder Ch I-	IM-
16	Buffered Motor Encoder Ch A+	AMOUT+
17	Buffered Motor Encoder Ch A-	AMOUT-

Pin	Description	Signal
18	Buffered Motor Encoder Ch B+	BMOUT+
19	Buffered Motor Encoder Ch B-	BMOUT-
20	Buffered Motor Encoder Ch I+	IMOUT+
21	Buffered Motor Encoder Ch I-	IMOUT-
22	Common	ACOM
23	Programmable Analog Output	AOUT
24	Analog Current Limit Input	ILIMIT
25	Command +	Command+
26	Command -	Command-
27	I/O Common	IOCOM
28	I/O Common	IOCOM
29	I/O Power	IOPWR
30	I/O Power	IOPWR
31	Digital Input 1	INPUT1
32	Digital Input 2	INPUT2
33	Digital Input 3	INPUT3
34	Digital Input 4	INPUT4

Pin	Description	Signal
35	Digital Input 5	INPUT5
36	Digital Input 6	INPUT6
37	Digital Input 7	INPUT7
38	Digital Input 8	INPUT8
39	Digital Output 1	OUTPUT1
40	Digital Output 2	OUTPUT2
41	Digital Output 3	OUTPUT3
42	Digital Output 4	OUTPUT4
43	Normally Open Relay Output+	RELAY+
44	Normally Open Relay Output-	RELAY-

Motor Encoder Connector Pins and Signals (CN2)

Quadrature Feedback (F-, H-, N- and Y-Series Motors)			High Resolution Feedback (MP-Series)		
Pin	Description	Signal	Pin	Description	Signal
1	Channel A+	AM+	1	Sine+	AM+
2	Channel A-	AM-	2	Sine-	AM-
3	Channel B+	BM+	3	Cosine+	BM+
4	Channel B-	BM-	4	Cosine-	BM-
5	Channel I+	IM+	5	Serial+	IM+
6	Common	ECOM	6	Common	ECOM
7	Encoder Power (+9V) ¹	EPWR_+9V ¹	7	Encoder Power (+9V) ¹	EPWR_+9V ¹
8	Commutation Channel S3	S3	8	Commutation Channel S3	S3
9	Positive Overtravel Limit	+LIMIT	9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-	10	Channel I-	IM-
11	Thermostat	TS	11	Thermostat	TS
12	Commutation Channel 1	S1	12	Commutation Channel 1	S1
13	Commutation Channel 2	S2	13	Commutation Channel 2	S2
14	Encoder Power (+5V)	EPWR_+5V	14	Encoder Power (+5V)	EPWR_+5V
15	Negative Overtravel Limit	-LIMIT	15	Negative Overtravel Limit	-LIMIT

¹ Description only applies to 3, 7.5 and 15 kW drives. For 500W, 1 kW and 2 kW drives, pin 7 is reserved.

Serial Port Connector Pins and Signals (CN3)

Pin	Description	Signal	Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+	6	Reserved	–
2	RS-232 Input	RCV	7	RS-422/RS-485 Input-	RCV-
3	RS-232 Output	XMT	8	RS-422/RS-485 Output-	XMT-
4	RS-422/RS-485 Output+	XMT+	9	Reserved	–
5	Common	COM			

Terminal Block

Ultra3000 500W, 1 kW and 2 kW Drives		
Pin	Description	Signal
1	DC Bus +	+1
2	DC Bus -1	-1
3	Main AC	L1
4	Main AC	L2/N
5	Safety (Earth) Ground	–
6	Motor	U
7	Motor	V
8	Motor	W
9	Motor Case Ground	–

Ultra3000 3 kW Drives		
Pin	Description	Signal
1	Motor	U
2	Motor	V
3	Motor	W
4	Motor Case Ground	–
5	DC Bus +	+1
6	DC Bus -1	-1
7	Main AC	L1
8	Main AC	L2/N
9	Safety (Earth) Ground	–
10	Auxiliary AC	L1
11	Auxiliary AC	L2/N

Ultra3000 7.5 and 15 kW Drives		
Pin	Description	Signal
1	Motor	U
2	Motor	V
3	Motor	W
4	Motor Case Ground	–
5	DC Bus +	+1
6	DC Bus -1	-1
7	Main AC	L1
8	Main AC	L2
9	Main AC	L3
10	Safety (Earth) Ground	–
11	Auxiliary AC	L1
12	Auxiliary AC	L2/N

Ultra3000-SE Connector Data

The following section contains the external connections, and the I/O, motor encoder, serial port, and terminal block connector pins and signals for Ultra3000 digital servo drives with the SERCOS interface.

Figure 2.18

Ultra3000-SE External Connections (500W, 1 kW, and 2 kW) (2098-DSD-0xx-SE)

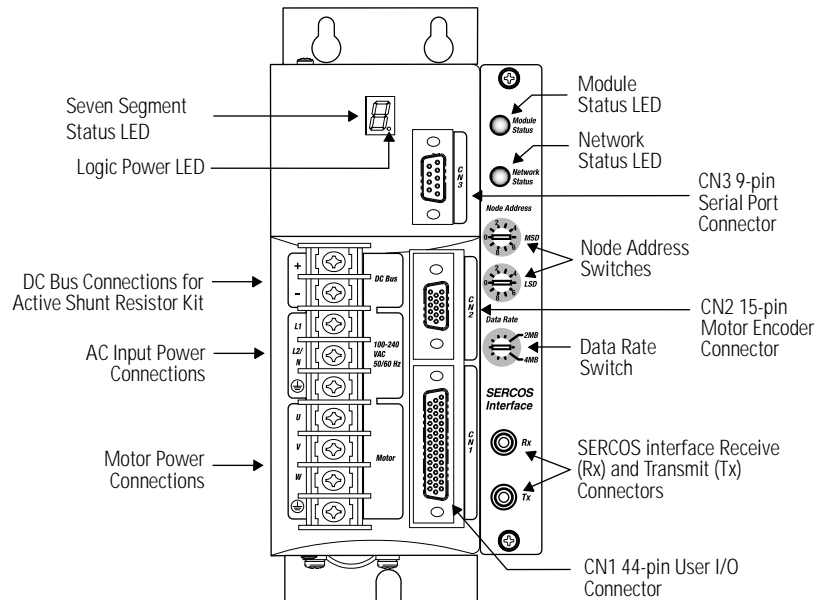


Figure 2.19

Ultra3000-SE External Connections (3 kW) (2098-DSD-0xxxx-SE)

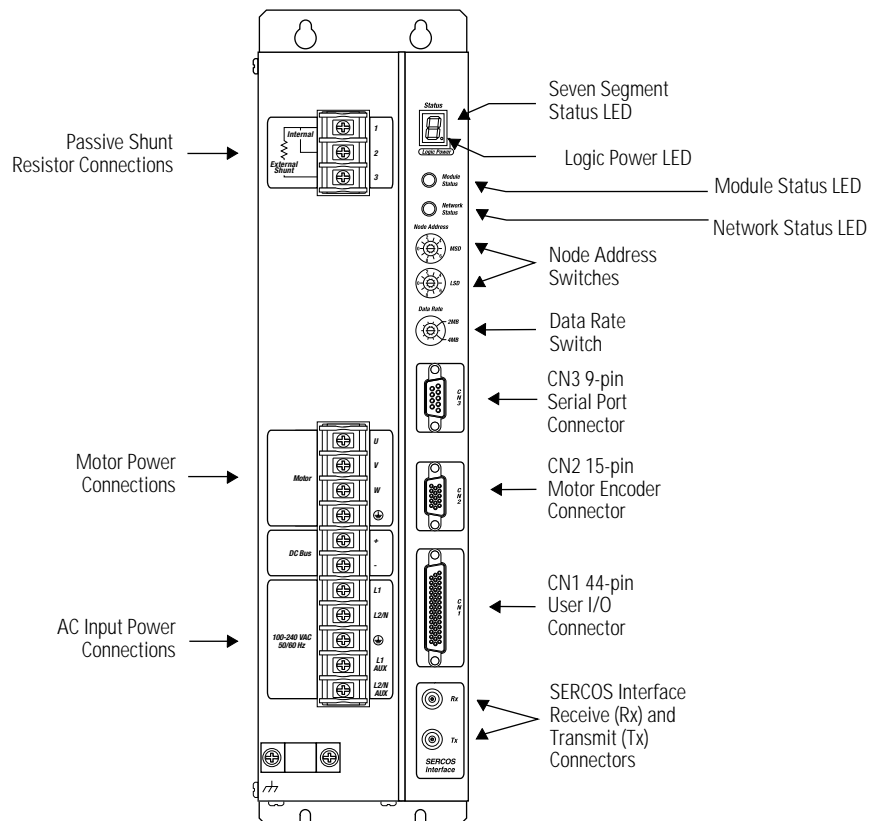
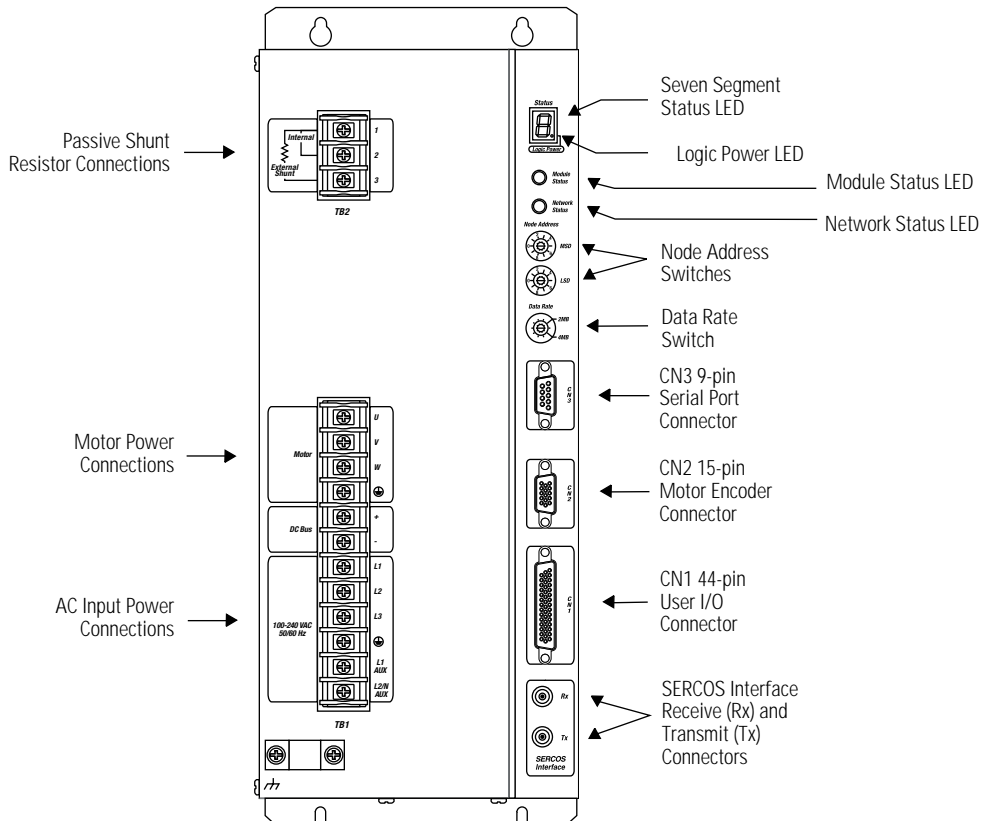


Figure 2.20
Ultra3000-SE External Connections (7.5 and 15 kW) (2098-DSD-xxx-SE)



I/O Connector Pins and Signals (CN1)

Pin	Description	Signal
1	Auxiliary Encoder Power Out (+5V)	EPWR
2	Common	ECOM
3	Auxiliary Logic Power In (+5V)	AUXPWR
4	Auxiliary Encoder Ch A+	AX+
5	Auxiliary Encoder Ch A-	AX-
6	Auxiliary Encoder Ch B+	BX+
7	Auxiliary Encoder Ch B-	BX-
8	Auxiliary Encoder Ch I+	IX+
9	Auxiliary Encoder Ch I-	IX-
10	Unbuffered Motor Encoder Ch A+	AM+
11	Unbuffered Motor Encoder Ch A-	AM-
12	Unbuffered Motor Encoder Ch B+	BM+
13	Unbuffered Motor Encoder Ch B-	BM-
14	Unbuffered Motor Encoder Ch I+	IM+
15	Unbuffered Motor Encoder Ch I-	IM-
16	Buffered Motor Encoder Ch A+	AMOUT+
17	Buffered Motor Encoder Ch A-	AMOUT-

Pin	Description	Signal
18	Buffered Motor Encoder Ch B+	BMOUT+
19	Buffered Motor Encoder Ch B-	BMOUT-
20	Buffered Motor Encoder Ch I+	IMOUT+
21	Buffered Motor Encoder Ch I-	IMOUT-
22	Common	ACOM
23	Programmable Analog Output	AOUT
24	Analog Current Limit Input	ILIMIT
25	Command +	Command+
26	Command -	Command-
27	I/O Common	IOCOM
28	I/O Common	IOCOM
29	I/O Power	IOPWR
30	I/O Power	IOPWR
31	Drive Enable Input	ENABLE
32	Home Sensor Input	HOME
33	Registration Sensor 1 Input	REG1
34	Registration Sensor 2 Input	REG2

Pin	Description	Signal
35	Digital Input 5	INPUT5
36	Digital Input 6	INPUT6
37	Positive Overtravel Input	OT_POS
38	Negative Overtravel Input	OT_NEG
39	Digital Output 1	OUTPUT1
40	Digital Output 2	OUTPUT2
41	Digital Output 3	OUTPUT3
42	Digital Output 4	OUTPUT4
43	Drive Ready Relay Output+	READY+
44	Drive Ready Relay Output-	READY-

Motor Encoder Connector Pins and Signals (CN2)

Quadrature Feedback (F-, H-, N- and Y-Series Motors)		
Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Encoder Power (+9V) ¹	EPWR_+9V ¹
8	Commutation Channel S3	S3
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel 1	S1
13	Commutation Channel 2	S2
14	Encoder Power (+5V)	EPWR_+5V
15	Negative Overtravel Limit	-LIMIT

High Resolution Feedback (MP-Series)		
Pin	Description	Signal
1	Sine+	AM+
2	Sine-	AM-
3	Cosine+	BM+
4	Cosine-	BM-
5	Serial+	IM+
6	Common	ECOM
7	Encoder Power (+9V) ¹	EPWR_+9V ¹
8	Commutation Channel S3	S3
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel 1	S1
13	Commutation Channel 2	S2
14	Encoder Power (+5V)	EPWR_+5V
15	Negative Overtravel Limit	-LIMIT

¹ Description only applies to 3, 7.5 and 15 kW drives. For 500W, 1 kW and 2 kW drives, pin 7 is reserved.

Serial Port Connector Pins and Signals (CN3)

Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+
2	RS-232 Input	RCV
3	RS-232 Output	XMT
4	RS-422/RS-485 Output+	XMT+
5	Common	COM

Pin	Description	Signal
6	Reserved	–
7	RS-422/RS-485 Input-	RCV-
8	RS-422/RS-485 Output-	XMT-
9	Reserved	–

Terminal Block

Ultra3000 500W, 1 kW and 2 kW Drives		
Pin	Description	Signal
1	DC Bus +	+1
2	DC Bus -1	-1
3	Main AC	L1
4	Main AC	L2/N
5	Safety (Earth) Ground	–
6	Motor	U
7	Motor	V
8	Motor	W
9	Motor Case Ground	–

Ultra3000 3 kW Drives		
Pin	Description	Signal
1	Motor	U
2	Motor	V
3	Motor	W
4	Motor Case Ground	–
5	DC Bus +	+1
6	DC Bus -1	-1
7	Main AC	L1
8	Main AC	L2/N
9	Safety (Earth) Ground	–
10	Auxiliary AC	L1
11	Auxiliary AC	L2/N

Ultra3000 7.5 and 15 kW Drives		
Pin	Description	Signal
1	Motor	U
2	Motor	V
3	Motor	W
4	Motor Case Ground	–
5	DC Bus +	+1
6	DC Bus -1	-1
7	Main AC	L1
8	Main AC	L2
9	Main AC	L3
10	Safety (Earth) Ground	–
11	Auxiliary AC	L1
12	Auxiliary AC	L2/N

Ultra3000-DN and -X-DN Connector Data

The following section contains the external connections, and the I/O, motor encoder, serial port, and terminal block connector pins and signals for Ultra3000 digital servo drives with the DeviceNet interface and the indexing DeviceNet interface.

Figure 2.21

Ultra3000-DN and Ultra3000-X-DN External Connections (500W, 1 kW, and 2 kW) (2098-DSD-0xxx-DN)

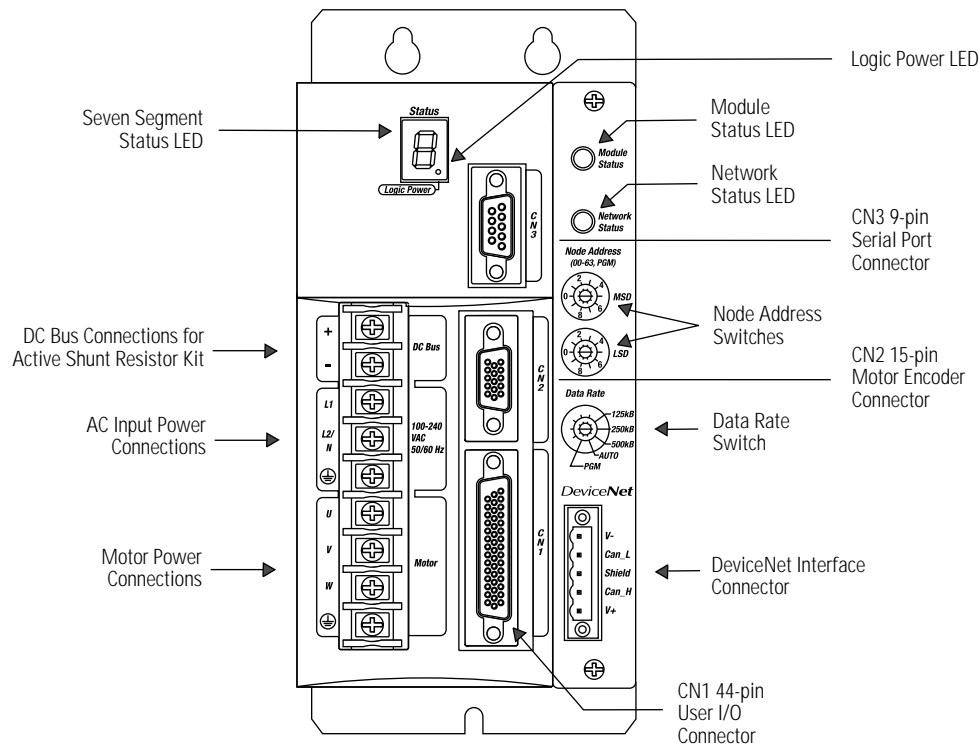


Figure 2.22
Ultra3000-DN and Ultra3000-X-DN External Connections (3 kW) (2098-DSD-0xxxxx-DN)

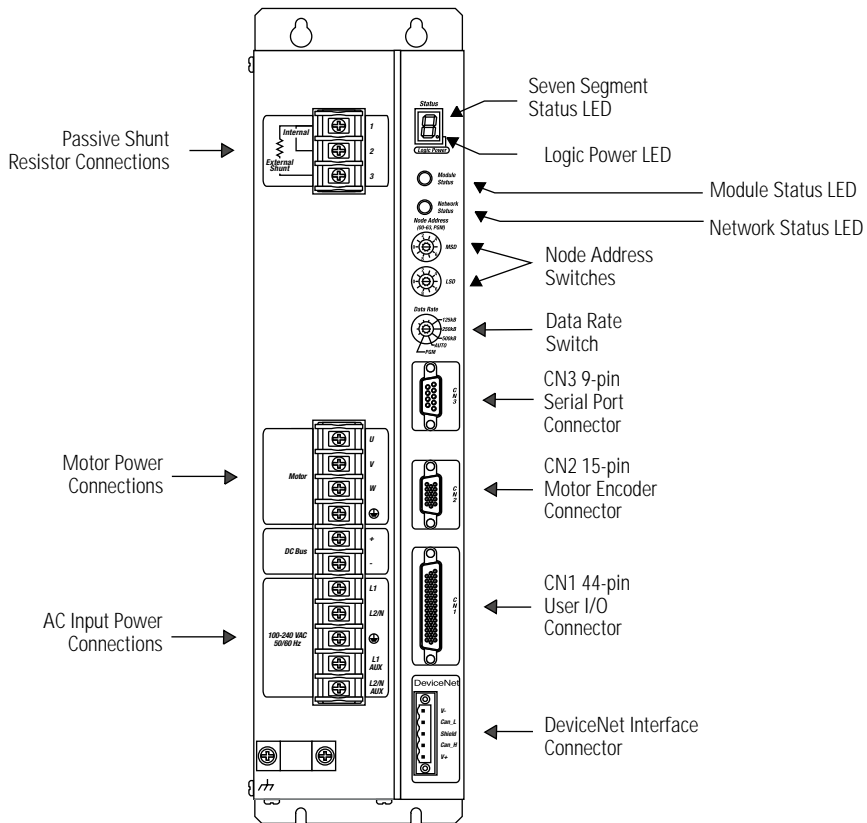
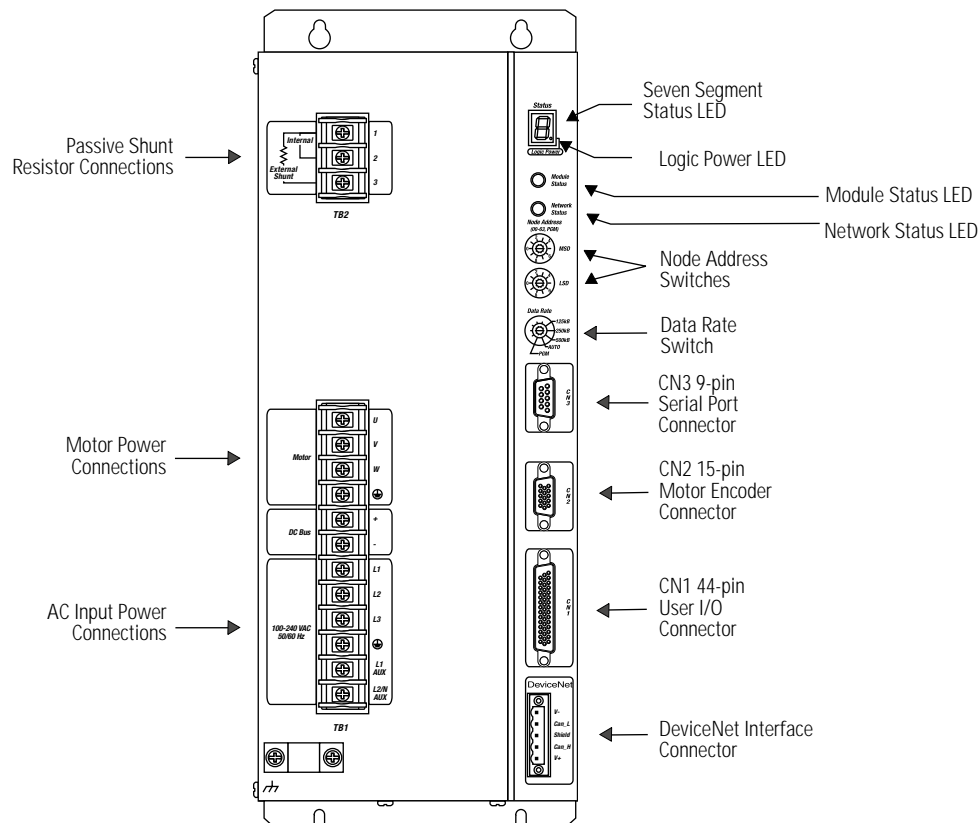


Figure 2.23
Ultra3000-DN and Ultra3000X-DN External Connections (7.5 and 15 kW) (2098-DSD-0xxxxxx-DN)



I/O Connector Pins and Signals (CN1)

Pin	Description	Signal
1	Auxiliary Encoder Power Out +5V DC	EPWR
2	Common	ECOM
3	Auxiliary Logic Power In +5V	AUXPWR
4	Auxiliary Encoder Ch A+	AX+
5	Auxiliary Encoder Ch A+	AX-
6	Auxiliary Encoder Ch B+	BX+
7	Auxiliary Encoder CH B-	BX-
8	Auxiliary Encoder Ch I+	IX+
9	Auxiliary Encoder Ch I-	IX-
10	Unbuffered Motor Encoder Ch A+	AM+
11	Unbuffered Motor Encoder Ch A-	AM-
12	Unbuffered Motor Encoder Ch B+	BM+
13	Unbuffered Motor Encoder Ch B-	BM-
14	Unbuffered Motor Encoder Ch I+	IM+
15	Unbuffered Motor Encoder Ch I-	IM-
16	Buffered Motor Encoder Ch A+	AMOUT+
17	Buffered Motor Encoder Ch A-	AMOUT-

Pin	Description	Signal
18	Buffered Motor Encoder Ch B+	BMOUT+
19	Buffered Motor Encoder Ch B-	BMOUT-
20	Buffered Motor Encoder Ch I+	IMOUT+
21	Buffered Motor Encoder Ch I-	IMOUT-
22	Common	ACOM
23	Programmable Analog Output	AOUT
24	Analog Current Limit Input	ILIMIT
25	Command +	Command+
26	Command -	Command-
27	I/O Common	IOCOM
28	I/O Common	IOCOM
29	I/O Power	IOPWR
30	I/O Power	IOPWR
31	Digital Input 1	INPUT1
32	Digital Input 2	INPUT2
33	Digital Input 3	INPUT3
34	Digital Input 4	INPUT4

Pin	Description	Signal
35	Digital Input 5	INPUT5
36	Digital Input 6	INPUT6
37	Digital Input 7	INPUT7
38	Digital Input 8	INPUT8
39	Digital Output 1	OUTPUT1
40	Digital Output 2	OUTPUT2
41	Digital Output 3	OUTPUT3
42	Digital Output 4	OUTPUT4
43	Normally Open Relay Output+	RELAY+
44	Normally Open Relay Output-	RELAY-

Motor Encoder Connector Pins and Signals (CN2)

Quadrature Feedback (F-, H-, N- and Y-Series Motors)		
Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Encoder Power (+9V) ¹	EPWR_+9V ¹
8	Commutation Channel S3	S3
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel 1	S1
13	Commutation Channel 2	S2
14	Encoder Power (+5V)	EPWR_+5V
15	Negative Overtravel Limit	-LIMIT

High Resolution Feedback (MP-Series)		
Pin	Description	Signal
1	Sine+	AM+
2	Sine-	AM-
3	Cosine+	BM+
4	Cosine-	BM-
5	Serial+	IM+
6	Common	ECOM
7	Encoder Power (+9V) ¹	EPWR_+9V ¹
8	Commutation Channel S3	S3
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel 1	S1
13	Commutation Channel 2	S2
14	Encoder Power (+5V)	EPWR_+5V
15	Negative Overtravel Limit	-LIMIT

¹ Description only applies to 3, 7.5 and 15 kW drives. For 500W, 1 kW and 2 kW drives, pin 7 is reserved.

Serial Port Connector Pins and Signals (CN3)

Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+
2	RS-232 Input	RCV
3	RS-232 Output	XMT
4	RS-422/RS-485 Output+	XMT+
5	Common	COM

Pin	Description	Signal
6	Reserved	–
7	RS-422/RS-485 Input-	RCV-
8	RS-422/RS-485 Output-	XMT-
9	Reserved	–

Terminal Block

Ultra3000 500W, 1 kW and 2 kW Drives		
Pin	Description	Signal
1	DC Bus +	+1
2	DC Bus -1	-1
3	Main AC	L1
4	Main AC	L2/N
5	Safety (Earth) Ground	–
6	Motor	U
7	Motor	V
8	Motor	W
9	Motor Case Ground	–

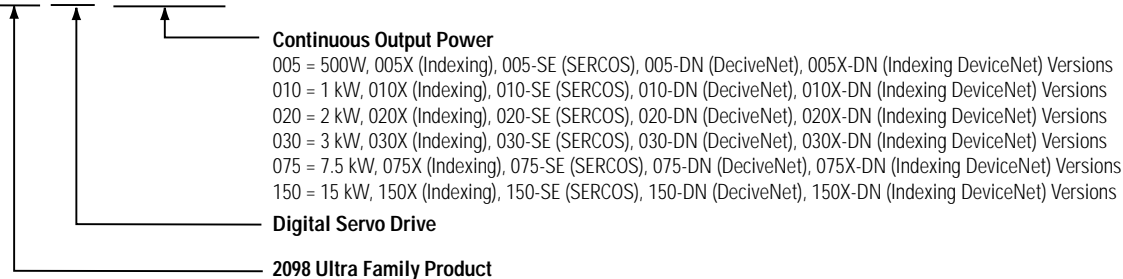
Ultra3000 3 kW Drives		
Pin	Description	Signal
1	Motor	U
2	Motor	V
3	Motor	W
4	Motor Case Ground	–
5	DC Bus +	+1
6	DC Bus -1	-1
7	Main AC	L1
8	Main AC	L2/N
9	Safety (Earth) Ground	–
10	Auxiliary AC	L1
11	Auxiliary AC	L2/N

Ultra3000 7.5 and 15 kW Drives		
Pin	Description	Signal
1	Motor	U
2	Motor	V
3	Motor	W
4	Motor Case Ground	–
5	DC Bus +	+1
6	DC Bus -1	-1
7	Main AC	L1
8	Main AC	L2
9	Main AC	L3
10	Safety (Earth) Ground	–
11	Auxiliary AC	L1
12	Auxiliary AC	L2/N

Ultra3000 Digital Servo Drive Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your drive. For questions regarding product availability, contact your Allen-Bradley distributor.

2098-DSD- 0xxxxx-xx



Intelligent Positioning Drives

Ultra5000™ Intelligent Positioning Drives



The Ultra5000 and Ultra5000-DN™ intelligent positioning drives make up a high-performance, fully programmable positioning servo drive family. The Ultra5000 servo drive family incorporates a state-of-the-art DSP-based control architecture and a rugged Integrated Power Module (IPM)-based power section. Ultra5000 drives are programmed using motion commands in an ANSI C format. The Ultra5000 design is optimized for high-speed position capturing and calculations. Position capture latency is less than one microsecond, and processing time for position-based calculations can be as low as 125 microseconds.

Each intelligent positioning drive features:

- Fully programmable controller to provide advanced motion control functions to any single-axis application.
- High-speed processing for increased axis performance and control capabilities.
- Motion control programs created in an ANSI C format for fast code execution and compact programs.
- Advanced math capabilities for the most demanding application calculations.
- Proven power architecture for reliability.
- User programs designed in an ANSI C format, which provides a standard programming format and includes the flexibility of arrays, structures, and libraries.
- Flexible, general purpose digital and analog I/O to satisfy cost-sensitive motion control applications with a single integrated package.
- Advanced feedback capabilities including absolute and high-resolution encoders.
- Direct connection to a PanelView operator interface for a complete automation solution.

Ultra5000-DN DeviceNet Intelligent Positioning Drive

In addition to the standard Ultra5000 features, the Ultra5000-DN intelligent positioning drive features:

- Communication over one industry-standard network, providing common end-user solutions to application challenges.
- Diagnostics that reduce downtime by providing accurate troubleshooting and failure warnings.
- Connectivity to automation systems using ControlLogix.

Ultra5000 Intelligent Positioning Drive System Overview

Figure 3.1
Ultra5000 Intelligent Positioning Drive System Overview

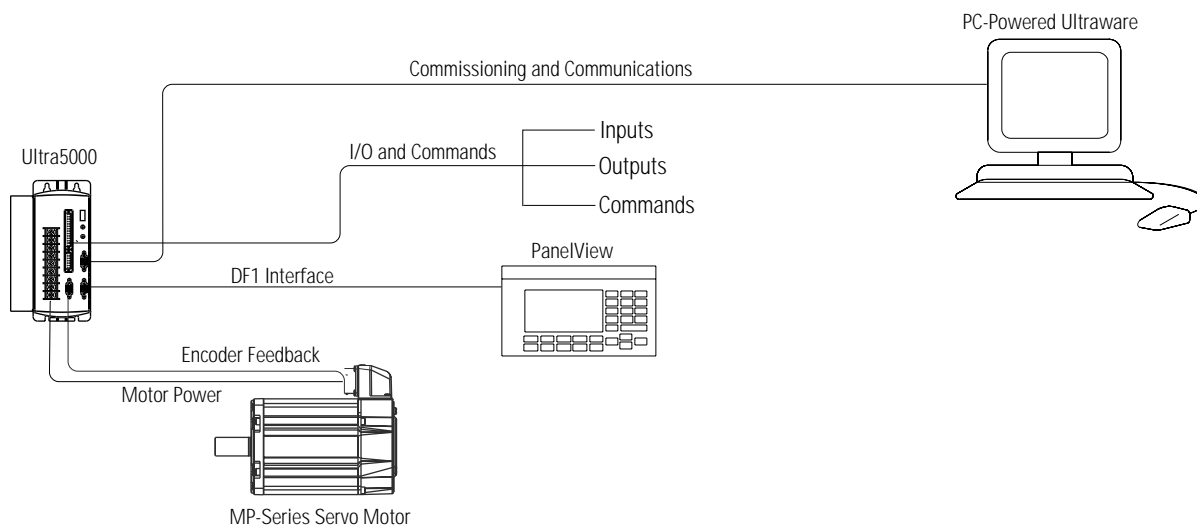
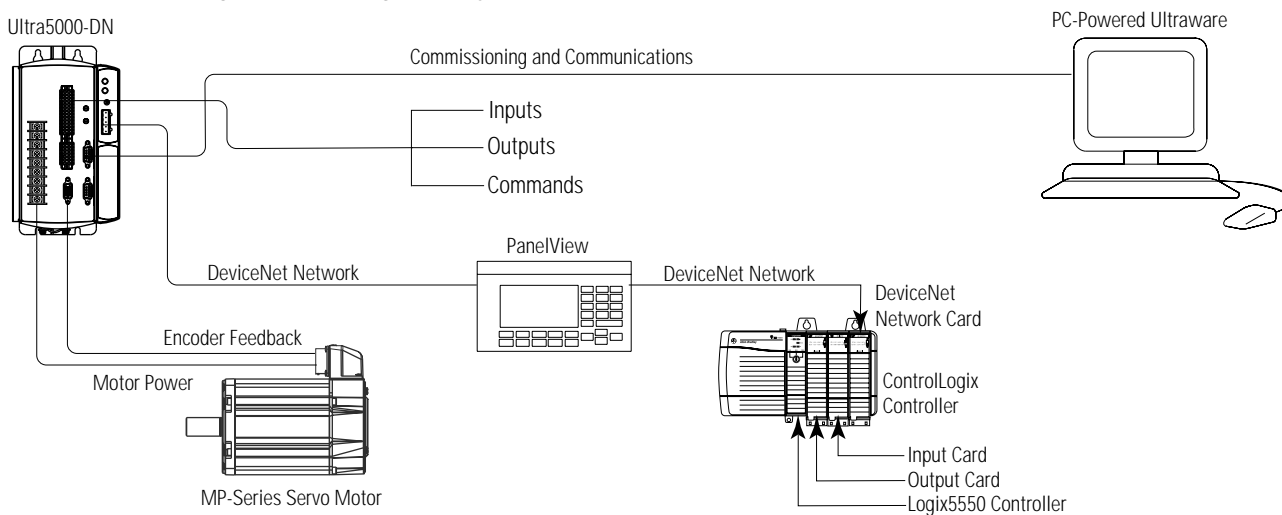


Figure 3.2
Ultra5000-DN Intelligent Positioning Drive System Overview



Note: To learn about the C programming environment or library of motion commands used to program an Ultra5000 intelligent positioning drive, refer to *Software*.

Ultra5000 Power Ratings

The following table contains the power ratings for all of the Ultra5000 intelligent positioning drives.

Model	Power Rating
2098-IPD-005x-xx	500W
2098-IPD-010x-xx	1 kW
2098-IPD-020x-xx	2 kW

Ultra5000 Intelligent Positioning Drive Specifications

The following section contains general, environmental, power input, power dissipation, controller, inputs/outputs, feedback, and serial communication port specifications for the Ultra5000 and Ultra5000-DN intelligent positioning drives.

General Specifications

Drive 2098-IPD-	Peak Output Current amps	Continuous Output Current amps	Continuous Output Power kW		Continuous Shunt Power External hp (watts)	Peak Shunt Power External kW	Energy Absorption Capability joules	
			120V AC	240V AC			120V	240V
005, 005-DN ²	7.5	2.5	0.25	0.5	0.402 (300) ¹	4 ¹	125	51
010, 010-DN ²	15	5	0.5	1				
020, 020-DN ²	30	10	1	2				

¹ Rating indicates use of 2090-USCR-A300 shunt resistor kit.

² The DN indicates the DeviceNet interface version of the drive.

Physical and Environmental Specifications

Specification	Description
Weight	2098-IPD-005 - 1.769 kg (3.9 lb) 2098-IPD-005-DN ¹ - 2.114 kg (4.65 lb) 2098-IPD-010 - 2.063 kg (4.55 lb) 2098-IPD-010-DN ¹ - 2.41 kg (5.3 lb) 2098-IPD-020 - 2.045 kg (4.51 lb) 2098-IPD-020-DN ¹ - 2.39 kg (5.26 lb)
Ambient Temperature	Storage: -40° C to 70° C (-40° F to 158° F) Operation: 0° C to 55° C (32° F to 131° F)
Relative Humidity	5-95% noncondensing
Altitude	1500 m (4921 ft) - Derate 3% per 300 m (984.3 ft) above 1500 m (984.3 ft)
Vibration	10-2000 Hz at 2g
Shock	15g, 11ms half-sine

¹ The DN indicates the DeviceNet interface version of the drive.

Power Input Specifications

Drives 2098-IPD-	Continuous Input Current amps (RMS)	Input Voltage	Input Frequency Hz	I/O Voltage V DC
005, -005-DN ¹	5	100-240V AC Single Phase	47-63	12-24V DC required for digital I/O
010, -010-DN ¹	9			
020, -020-DN ¹	18			

¹ The DN indicates the DeviceNet interface version of the drive.

Power Dissipation Specifications

Drives 2098-IPD-	Power Dissipation watts
005, 005-DN ¹	48 + dissipative shunt
010, 010-DN ¹	48 + dissipative shunt
020, 020-DN ¹	50 + dissipative shunt

¹ The DN indicates the DeviceNet interface version of the drive.

Controller Specifications

Specification	Description
Processor	Texas Instruments TMS320C32 32-bit Floating Point Digital Signal Processor
Clock Speed	60 Mhz
Commutation	3-Phase Sinusoidal Space Vector Modulated (SVM)
Current Regulator	Digital PI - 125 µsec update rate
Velocity Regulator	Digital PI - 250 µsec update rate
Position Regulator	Digital PI - 500 µsec update rate
PWM	8 kHz, space vector modulation
Position Range	32-bit signed
Velocity/Acceleration Range	32-bit floating point
Electronic Gearing	64-bit signed

Inputs/Outputs Specifications

Specification	Description
General Purpose Digital Inputs	16 Optically Isolated 12-24V
Inputs/Outputs - Sinking/Sourcing Selection	Group Selection as Active High, Current Sinking or Active Low, Current Sourcing
High-Speed Input Response	<1 µsec (inputs 1 and 2)
General Purpose Analog Inputs	Two 12-Bit Analog to Digital Converters (±10V, single-ended)
General Purpose Analog Outputs	Two 12-Bit Digital to Analog Converters (±10V, ±2 mA, single-ended)
Position Capture Response ¹	<1 µsec (inputs 1 and 2, Motor Encoder Index, and Auxiliary Encoder Index)
General Purpose Relay Output	1 Normally Open Relay - 30V DC Maximum Voltage, 1 Amp Maximum Current
General Purpose Digital Outputs	7 Optically Isolated 12-24V Outputs - 50 Milliampere Maximum
General Purpose I/O Response	100 µs
Digital I/O Firmware Scan Period	125 µs

¹ Inputs 1 and 2 are interfaced using high-speed opto-couplers to the gate array providing extremely fast position capture capability.

Feedback Specifications

Motor Feedback	
Specification	Description
Encoder Types	Incremental, Sine/Cosine, Intelligent, and Absolute
Maximum Input Frequency	2.5 MHz (TTL Input) per channel
	100 kHz (Sine/Cosine Input)
Commutation Feedback	Hall Sensor

Auxiliary Feedback	
Specification	Description
Input Modes	A quad B
Maximum Input Frequency	2.5 MHz
Input Types	Differential, single-ended, open collector ¹

Serial Communication Port Specifications

Communication Type	Port Type	Baud Rate
Serial	RS-232, RS-422, RS-485	1,200-38,400

Connectors Specifications

Connector	Specification	Description
CN1A	Digital Input/Output	28-pin pluggable spring clamp
CN1B	Analog Input/Output	14-pin pluggable spring clamp
CN2	Motor Feedback Connector	15-pin high-density D-shell
CN3A	Main Serial Port Connector	9-pin standard D-Shell
CN3B	Auxiliary Serial Port Connector	9-pin standard D-Shell

Ultra5000 Intelligent Positioning Drive Dimensions

The following section contains dimensions for the 500W, 1 kW, and 2 kW Ultra5000 and Ultra5000-DN intelligent positioning drives.

Figure 3.3
Ultra5000 (500W) Dimensions (2098-IPD-005)

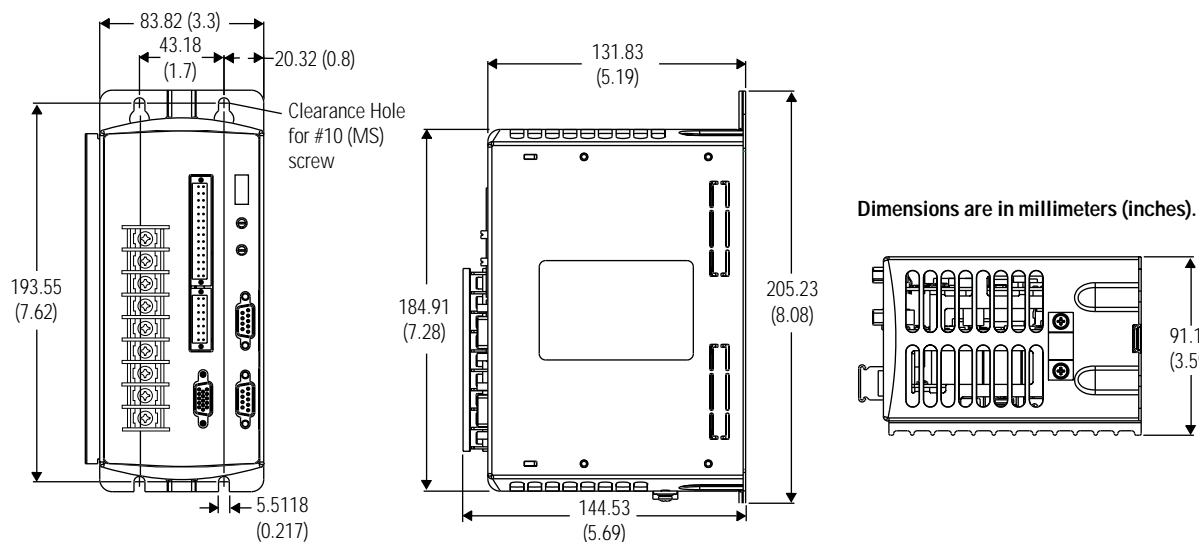


Figure 3.4
Ultra5000 (1 kW, 2 kW) Dimensions (2098-IPD-010, 2098-IPD-020)

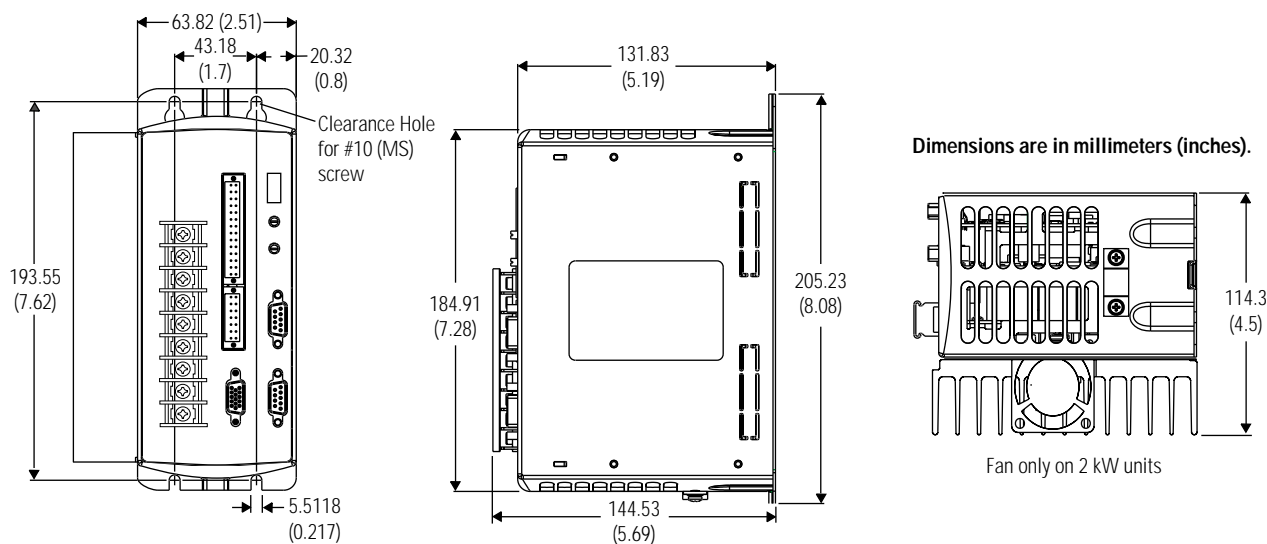


Figure 3.5
Ultra5000-DN (500W) Dimensions (2098-IPD-005-DN)

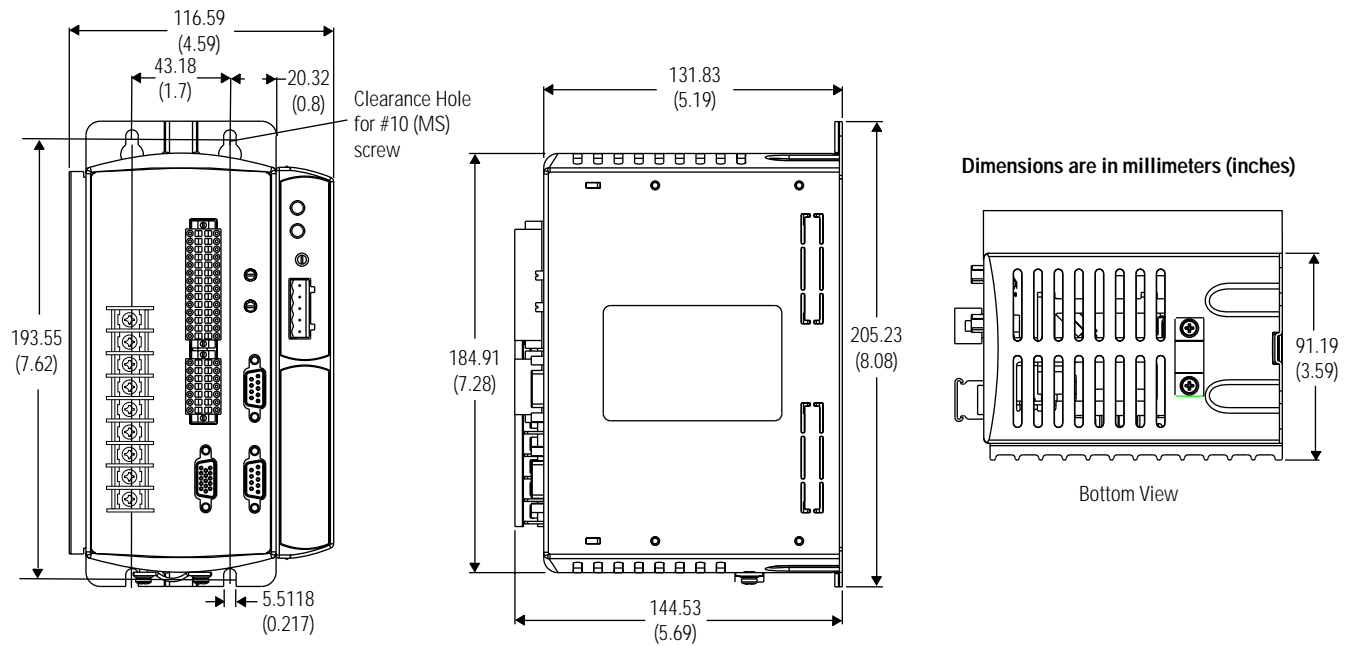
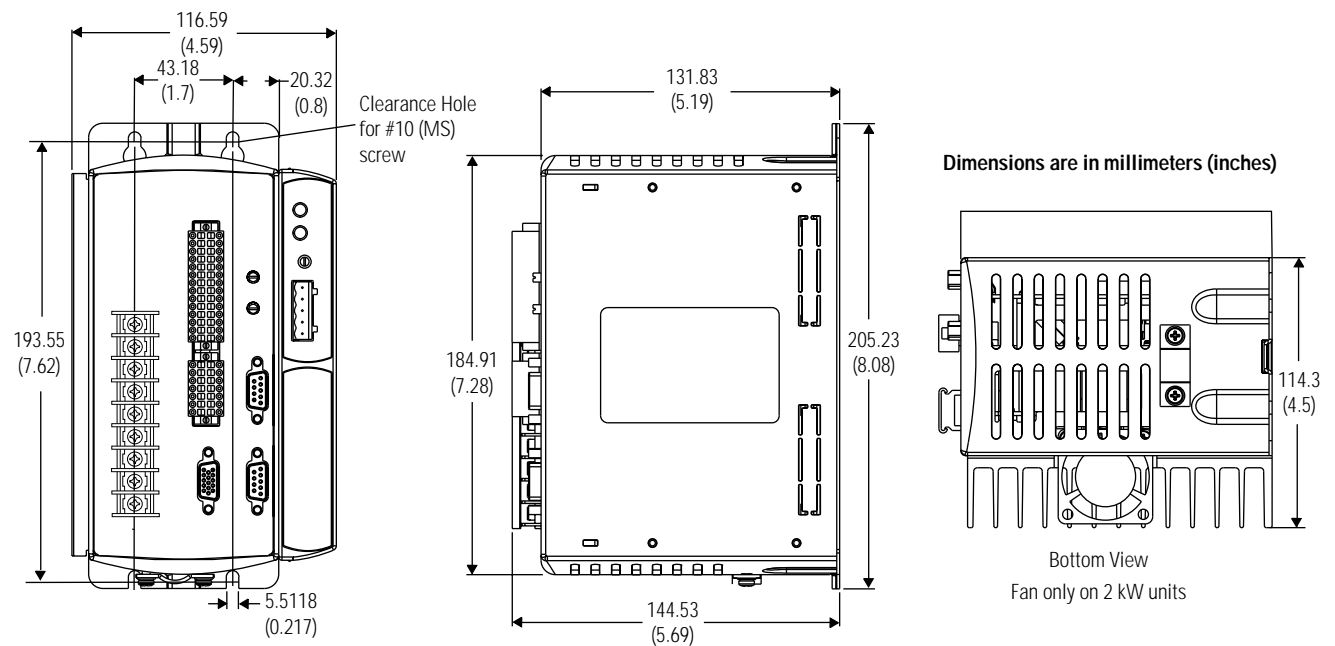


Figure 3.6
Ultra5000-DN (1 kW, 2 kW) Dimensions (2098-IPD-010-DN, 2098-IPD-020-DN)

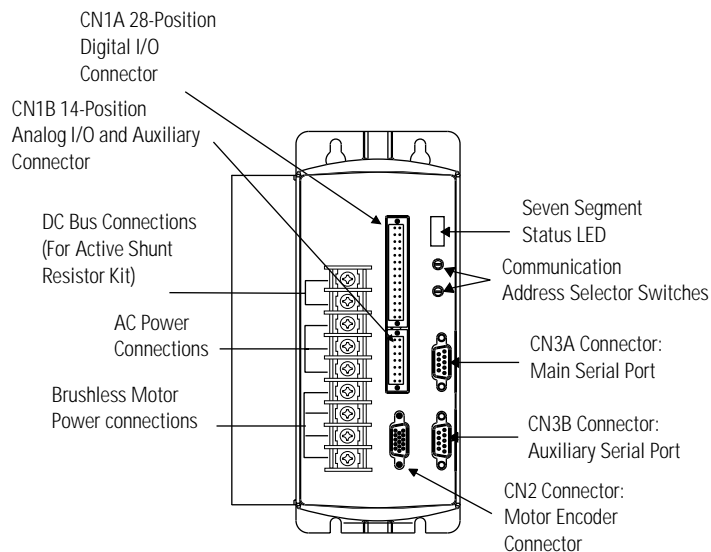


Ultra5000 Connector Data

The following section provides the Ultra5000 and Ultra5000 DeviceNet external connections, and the auxiliary encoder, analog I/O, motor encoder, serial port, and terminal block connector pins and signals.

Figure 3.7

Ultra5000 External Connections (2098-IPD-0xx)



Digital I/O Connector Pins and Signals (CN1A)

Pin	Description	Signal
1	Digital Input 1	INPUT1
2	Digital Input 2	INPUT2
3	Digital Input 3	INPUT3
4	Digital Input 4	INPUT4
5	Digital Input 5	INPUT5
6	Digital Input 6	INPUT6
7	Digital Input 7	INPUT7
8	Digital Input 8	INPUT8
9	Digital Output 1	OUTPUT1
10	Digital Output 2	OUTPUT2
11	Digital Output 3	OUTPUT3
12	Digital Output 4	OUTPUT4
13	Shield Termination	SHIELD
14	External I/O Power Supply	IOPWR

Pin	Description	Signal
15	Digital Input 9	INPUT9
16	Digital Input 10	INPUT10
17	Digital Input 11	INPUT11
18	Digital Input 12	INPUT12
19	Digital Input 13	INPUT13
20	Digital Input 14	INPUT14
21	Digital Input 15	INPUT15
22	Digital Input 16	INPUT16
23	Digital Output 5	OUTPUT5
24	Digital Output 6	OUTPUT6
25	Digital Output 7	OUTPUT7
26	Relay Output 8+	OUTPUT8+
27	Relay Output 8-	OUTPUT8-
28	External I/O Ground	IOCOM

Auxiliary Encoder and Analog I/O Connector Pins and Signals (CN1B)

Pin	Description	Signal	Pin	Description	Signal
1	5V Power Supply	+5V	8	5V Ground	+5VCOM
2	Auxiliary Encoder Input/Output A+	AX+	9	Analog Input 1	AIN1
3	Auxiliary Encoder Input/Output A-	AX-	10	Analog Input 2	AIN2
4	Auxiliary Encoder Input/Output B+	BX+	11	5V Ground	+5VCOM
5	Auxiliary Encoder Input/Output B-	BX-	12	Analog Output 1	AOUT1
6	Auxiliary Encoder Input/Output I+	IX+	13	Analog Output 2	AOUT2
7	Auxiliary Encoder Input/Output I-	IX-	14	Shield Termination	SHIELD

Motor Encoder Connector Pins and Signals (CN2)

Quadrature Feedback (F-, H-, N- and Y-Series Motors)			High Resolution Feedback (MP-Series)		
Pin	Description	Signal	Pin	Description	Signal
1	Channel A+	AM+	1	Sine+	AM+
2	Channel A-	AM-	2	Sine-	AM-
3	Channel B+	BM+	3	Cosine+	BM+
4	Channel B-	BM-	4	Cosine-	BM-
5	Channel I+	IM+	5	Serial+	IM+
6	Common	ECOM	6	Common	ECOM
7	Encoder Power (+9V) ¹	EPWR_+9V ¹	7	Encoder Power (+9V) ¹	EPWR_+9V ¹
8	Commutation Channel S3	S3	8	Commutation Channel S3	S3
9	Positive Overtravel Limit	+LIMIT	9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-	10	Channel I-	IM-
11	Thermostat	TS	11	Thermostat	TS
12	Commutation Channel 1	S1	12	Commutation Channel 1	S1
13	Commutation Channel 2	S2	13	Commutation Channel 2	S2
14	Encoder Power (+5V)	EPWR_+5V	14	Encoder Power (+5V)	EPWR_+5V
15	Negative Overtravel Limit	-LIMIT	15	Negative Overtravel Limit	-LIMIT

¹ Description only applies to 3, 7.5 and 15 kW drives. For 500W, 1 kW and 2 kW drives, pin 7 is reserved.

Serial Port Connector Pins and Signals (CN3A and CN3B)

Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+
2	RS-232 Input	RCV
3	RS-232 Output	XMT
4	RS-422/RS-485 Output+	XMT+
5	Logic Ground	DGND

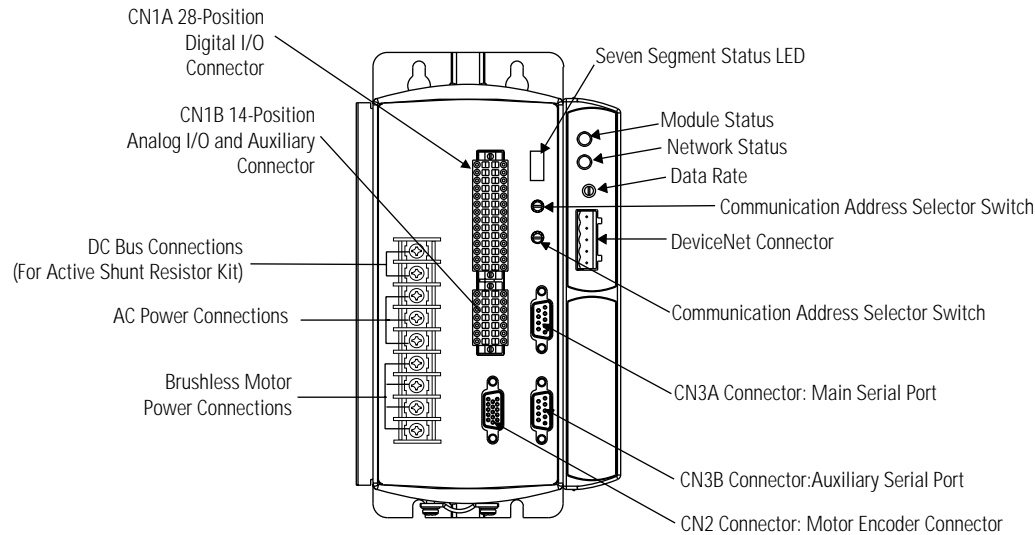
Pin	Description	Signal
6	Not Connected	–
7	RS-422/RS-485 Input-	RCV-
8	RS-422/RS-485 Output-	XMT-
9	Not Connected	–

Terminal Block

Pin	Description	Signal
1	DC Bus +	+1
2	DC Bus -1	-1
3	Line 1	L1
4	Line 2	L2
5	Safety (Earth) Ground	–

Pin	Description	Signal
6	Motor	U
7	Motor	V
8	Motor	W
9	Motor Case Ground	–

Figure 3.8
Ultra5000 DeviceNet External Connections (2098-IPD-DN-0xx-DN)



Digital I/O Connector Pins and Signals (CN1A)

Pin	Description	Signal	Pin	Description	Signal
1	Digital Input 1	INPUT1	15	Digital Input 9	INPUT9
2	Digital Input 2	INPUT2	16	Digital Input 10	INPUT10
3	Digital Input 3	INPUT3	17	Digital Input 11	INPUT11
4	Digital Input 4	INPUT4	18	Digital Input 12	INPUT12
5	Digital Input 5	INPUT5	19	Digital Input 13	INPUT13
6	Digital Input 6	INPUT6	20	Digital Input 14	INPUT14
7	Digital Input 7	INPUT7	21	Digital Input 15	INPUT15
8	Digital Input 8	INPUT8	22	Digital Input 16	INPUT16
9	Digital Output 1	OUTPUT1	23	Digital Output 5	OUTPUT5
10	Digital Output 2	OUTPUT2	24	Digital Output 6	OUTPUT6
11	Digital Output 3	OUTPUT3	25	Digital Output 7	OUTPUT7
12	Digital Output 4	OUTPUT4	26	Relay Output 8+	OUTPUT8+
13	Shield Termination	SHIELD	27	Relay Output 8-	OUTPUT8-
14	I/O Power Supply	IOPWR	28	I/O Ground	IOCOM

Auxiliary Encoder and Analog I/O Connector Pins and Signals (CN1B)

Pin	Description	Signal	Pin	Description	Signal
1	5V Power Supply	+5V	8	5V Ground	+5VCOM
2	Auxiliary Encoder Input/Output A+	AX+	9	Analog Input 1	AIN1
3	Auxiliary Encoder Input/Output A-	AX-	10	Analog Input 2	AIN2
4	Auxiliary Encoder Input/Output B+	BX+	11	5V Ground	+5VCOM
5	Auxiliary Encoder Input/Output B-	BX-	12	Analog Output 1	AOUT1
6	Auxiliary Encoder Input/Output I+	IX+	13	Analog Output 2	AOUT2
7	Auxiliary Encoder Input/Output I-	IX-	14	Shield Termination	SHIELD

Motor Encoder Connector Pins and Signals (CN2)

Quadrature Feedback (F-, H-, N- and Y-Series Motors)			High Resolution Feedback (MP-Series)		
Pin	Description	Signal	Pin	Description	Signal
1	Channel A+	AM+	1	Sine+	AM+
2	Channel A-	AM-	2	Sine-	AM-
3	Channel B+	BM+	3	Cosine+	BM+
4	Channel B-	BM-	4	Cosine-	BM-
5	Channel I+	IM+	5	Serial+	IM+
6	Common	ECOM	6	Common	ECOM
7	Encoder Power (+9V) ¹	EPWR_+9V ¹	7	Encoder Power (+9V) ¹	EPWR_+9V ¹
8	Commutation Channel S3	S3	8	Commutation Channel S3	S3
9	Positive Overtravel Limit	+LIMIT	9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-	10	Channel I-	IM-
11	Thermostat	TS	11	Thermostat	TS
12	Commutation Channel 1	S1	12	Commutation Channel 1	S1
13	Commutation Channel 2	S2	13	Commutation Channel 2	S2
14	Encoder Power (+5V)	EPWR_+5V	14	Encoder Power (+5V)	EPWR_+5V
15	Negative Overtravel Limit	-LIMIT	15	Negative Overtravel Limit	-LIMIT

¹ Description only applies to 3, 7.5 and 15 kW drives. For 500W, 1 kW and 2 kW drives, pin 7 is reserved.

Serial Port Connector Pins and Signals (CN3A and CN3B)

Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+
2	RS-232 Input	RCV
3	RS-232 Output	XMT
4	RS-422/RS-485 Output+	XMT+
5	Logic Ground	DGND

Pin	Description	Signal
6	Not Connected	–
7	RS-422/RS-485 Input-	RCV-
8	RS-422/RS-485 Output-	XMT-
9	Not Connected	–

DeviceNet Connector Pins and Signals (P2)

Pin	Description	Signal
1	Network Power Common 24V DC	V-
2	Network Communication Signal Line	Can_L
3	Shield	Shield
4	Network Communication Signal Line	Can_H
5	Network Power 24V DC	V+

Terminal Block

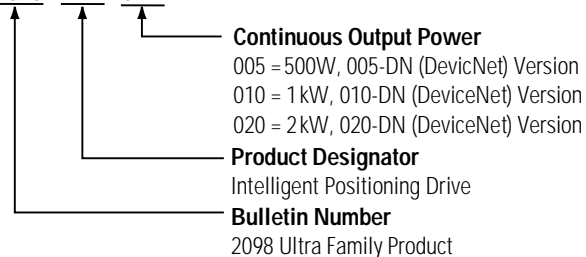
Pin	Description	Signal
1	DC Bus +	+1
2	DC Bus -1	-1
3	Line 1	L1
4	Line 2	L2
5	Safety (Earth) Ground	–

Pin	Description	Signal
6	Motor	U
7	Motor	V
8	Motor	W
9	Motor Case Ground	–

Ultra5000 Intelligent Positioning Drives Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your drive. For questions regarding product availability, contact your Allen-Bradley distributor.

2098 - IPD - 0xx



1394 Drive System Family

The 1394 Family



The 1394 is a modular, multi-axis motion control and drive system family. All 1394 systems provide direct line connection (transformerless) for 360 and 480V three-phase input power, efficient IGBT power conversion, and slide-and-lock, module-to-module connection systems. Each system module can be configured with up to four axis modules, with each axis module interfacing to a motor. The 1394 provides significant panel space and interconnect savings.

The 1394's unique design allows it to be used as:

- A SERCOS interface drive for Logix systems
- A GMC or GMC Turbo system
- An integrated 9/440 CNC system
- A 9/Series CNC digital interface drive system
- An analog servo drive system

What is the 1394 System?

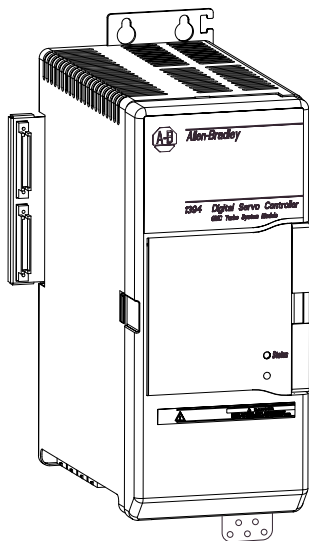
The various 1394 systems consist of the following components:

- One digital or analog System Module (1394x-SJTxx-x)
- One to four Axis Modules (1394x-AMxx-xx)
- One to four servo motors (1326AB/AS for non-SERCOS and 1326AB/AS and MP-Series for SERCOS)
- One to four power and feedback cables

1394 System Modules

System modules, available with ratings of 5, 10 and 22 kW (at 460V), house the system control PCB and convert 360 or 480VAC, three-phase, 50/60 Hz input power to a 530 or 680V DC link voltage. The 5 and 10 kW system modules have an internal shunt resistor with a 200W continuous rating and a peak rating of 40,000W. For 5 and 10 kW system modules, there is also available an optional external shunt module with a 1,400W continuous rating and a peak rating of 40,000W. The 22 kW system module requires an external shunt module with a 300 to 3,600W continuous rating and a peak rating of 160,000W.

Figure 4.1
1394 System Module (1394x-SJTxx-x)



1394 System Module Series Information

System Module Features	Feature Availability			
	Series C		Series A and B	
	5 and 10 kW Systems	22 kW Systems	5 and 10 kW Systems	22 kW Systems
Connector (plug-in) input power terminations	Yes	No	No	No
Cable Clamp (strain relief, shield bond)	Yes	Yes	No	No
EMI filter (24V input power)	Yes	No	No	No
EMI filter (registration)	Yes	Yes	No	No
Smart Power (Soft Start, power monitor)	Yes	Yes	No	Yes

Note: Series C system modules are physically interchangeable with Series A and B.

System Modules Specifications

The following section contains the specifications for 1394, 1394 SERCOS interface and 9/440 CNC system modules.

1394 System Modules Specifications

Specification	System Modules		
	1394x-SJT05 ^{1,2}	1394x-SJT10 ^{1,2}	1394x-SJT22 ¹
Rated AC input voltage	324-528V AC, 50/60 Hz 3-phase	324-528V AC, 50/60 Hz 3-phase	324-528V AC, 50/60 Hz 3-phase
AC input current	6.5A	13.0A	28.6A
Peak inrush current ^{3,4} (1394) ²	975A	1300A	697A < 1 μs
Peak inrush current ³ (1394C)	8A	8A	8A
Line loss ride through	20 ms	20 ms	20 ms
Nominal bus output voltage	530/680V DC	530/680V DC	530/680V DC
Continuous power output	4/5 kW	8/10 kW	17/22 kW
Peak power output ⁵	28 kW	28 kW	136 kW
Efficiency	99%	99%	98%
Weight (Series A and B)	11 kg (24.25 lb)	11 kg (24.25 lb)	12.7 kg (28.0 lb)
Weight (Series C)	10.68 kg (23.5 lb)	10.68 kg (23.5 lb)	12.9 kg (28.5 lb)
Continuous current output	7.36A	14.73A	33.8A
Peak current output	15.0A	29.46A	200A
Capacitance (Series A and B)	220 μF	330 μF	660 μF
Capacitance (Series C)	220 μF	345 μF	660 μF
Inductance	1000 μH	750 μH	500 μH
Internal shunt resistor	200W continuous, 40,000W peak (two second maximum on time)		No internal shunt resistor

¹ The Standard GMC and GMC Turbo system modules are identical except that the GMC Turbo (1394x-SJTxx-T) offers a SLC backplane interface and 64K of memory with a 32-bit processor while the Standard GMC (1394x-SJTxx-C) offers 32K of program memory with a 16-bit processor without the SLC interface.

² The Standard GMC (1394C-SJTxx-L) is functionally the same as the (1394x-SJTxx-C) except it supports one axis and provides two auxiliary encoder inputs.

³ 5 and 10 kW (Series C) system modules and all 22 kW system modules are limited to four contactor cycles per minute. 5 and 10 kW (Series A and B) system modules are limited to an average of four contactor cycles per hour.

⁴

$$\text{Peak inrush current for 5 and 10 kW systems (Series A and B)} = \frac{(\text{Line voltage} \times 1.1 \times \sqrt{2})}{\sqrt{\left(\frac{L_{\text{system}}}{C_{\text{system}} + C_{\text{axes}}} \right)}}$$

Where: L = Inductance
C = Capacitance

Peak inrush current for 22 kW (all Series) and 5 and 10 kW (Series C) systems is limited by an internal 80 ohm resistor. 8A peak inrush current for all Series C system modules will experience no more than a 40A peak loss (less 1 ms).

⁵ The Peak Power Output rating for 5 and 10 kW (Series A and B) is based on the thermal limits of the modules. The Peak Power Output rating for 22 kW (all Series) and 5 and 10 kW (Series C) is based on a current limit of 105% of two times the rated Continuous Current Output for 600 ms or the rated Peak Power Output for a duration equal to the equivalent watt-seconds.

9/440 CNC System Modules Specifications

System Model 8520-	Version	Specifications			
		Axis Modules	Resolver Feedback Ports	Analog Outputs	Encoder Feedback Ports
1Sx	1 Axis	1	1	2	0
3Sx	3 Axis	3	3 ¹	2	1 ¹
4Sx	4 Axis	4	4 ²	2	3 ²

¹ You can connect a total of three feedback devices. If you use three resolvers, the encoder port (J11) is not available. If you use the encoder feedback port (J11), the third resolver feedback (J3) is disabled.

² You can connect a total of six feedback devices. If you use four resolvers, the last encoder port (J11) is not available. If you use all three encoder feedback ports, the third resolver feedback (J3) is disabled.

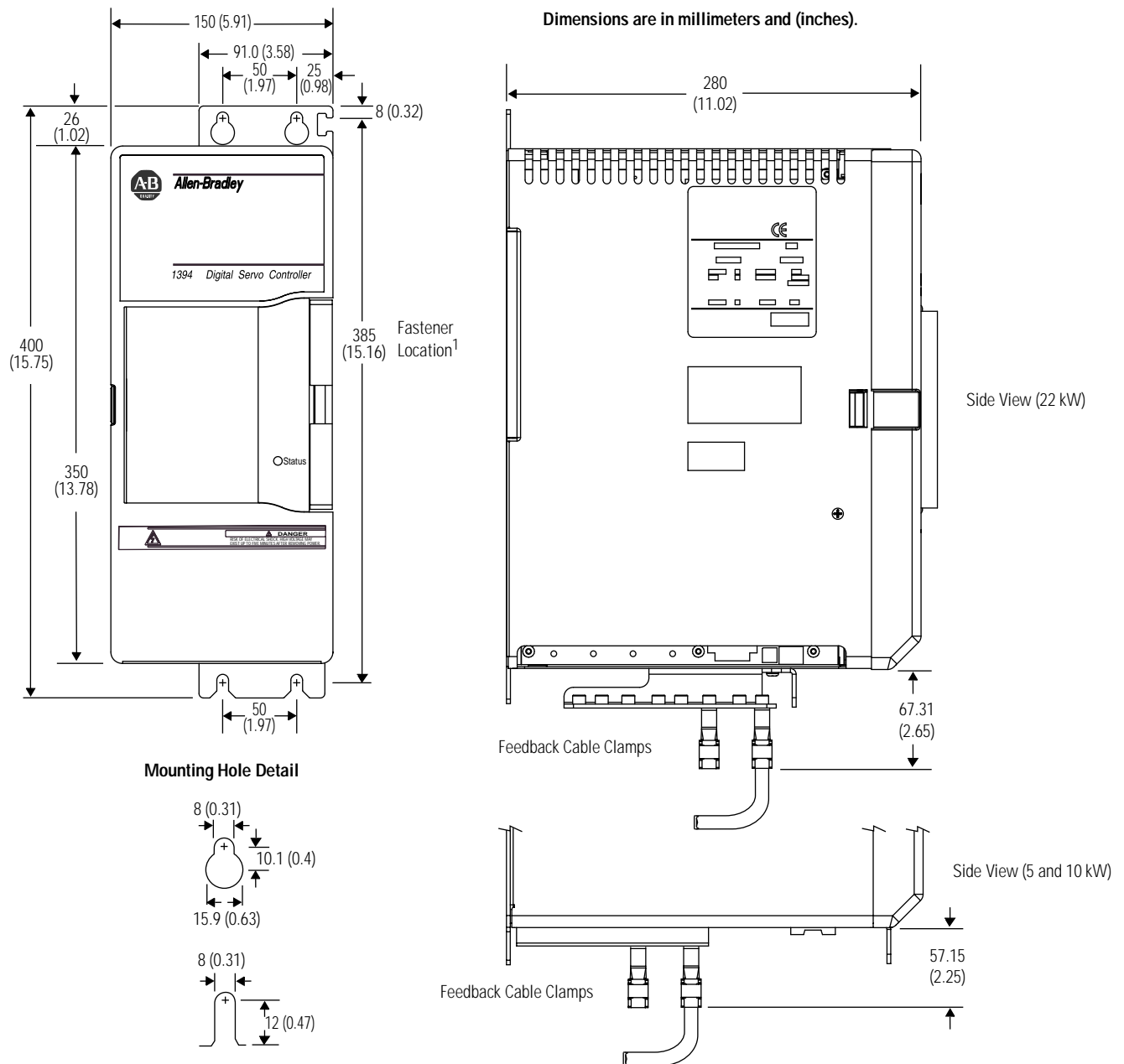
1394 System Module Dimensions

The following section contains the system module dimensions for the 1394, 1394 SERCOS interface, 9/440, and CNC interface systems.

GMC, Analog, SERCOS, 9/440, and CNC Interface

Figure 4.2

1394 System Module Dimensions (1394x-SJT05, 1394x-SJT10, 1394x-SJT22 - for all systems except GMC Turbo)



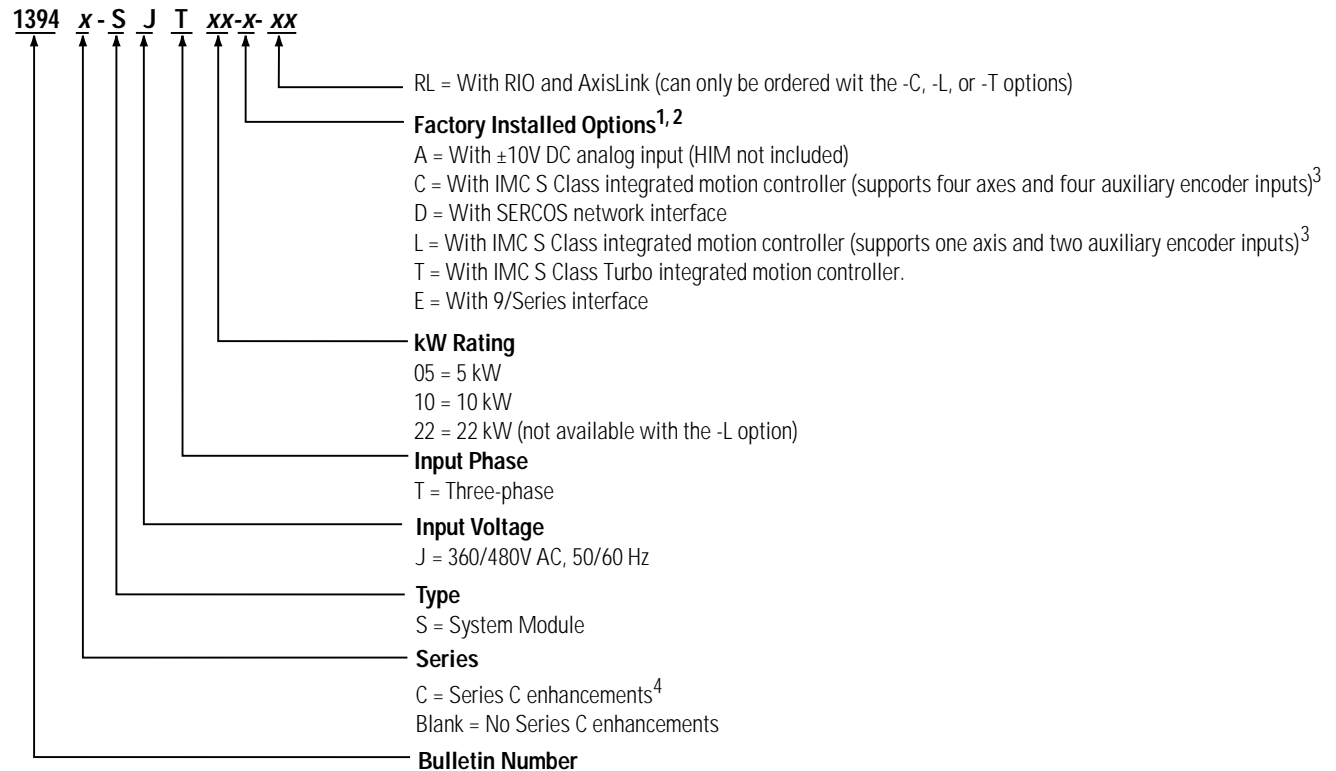
All slots accept M6 or 1/4-20 Mtg. screws.

¹ Dimension shown is for mounting hardware location and does not reflect the location of the lower slot radius.

System Module Catalog Numbers

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering table chart below to understand the configuration of your system module. For questions regarding product availability, contact your Allen-Bradley distributor.

1394 System Module



¹ The Standard GMC and GMC Turbo system modules are identical except that the GMC Turbo (1394x-SJTxx-T) offers a SLC backplane interface and 64K of memory with a 32-bit processor while the Standard GMC (1394x-SJTxx-C) offers 32K of program memory with a 16-bit processor without the SLC interface.

² The Standard GMC (1394C-SJTxx-L) is functionally the same as the (1394x-SJTxx-C) except it supports one axis and provides two auxiliary encoder inputs.

³ Only available on 5 and 10 kW system modules.

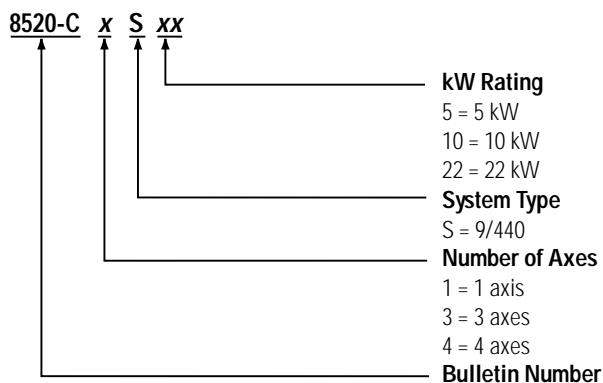
⁴ Enhanced system modules have Smart Power, improved terminations, and EMI filtering. Enhancements are available only with 1394C-SJTxx-A, -C, -D, -L, and -T system modules.

9/440 CNC System Module

The 9/440 CNC system module gives you all the power and programming capabilities of a 9-Series CNC, embedded into the compact packaging of the 1394 System Module. The 9/440 CNC System Module provides terminating points for the following equipment:

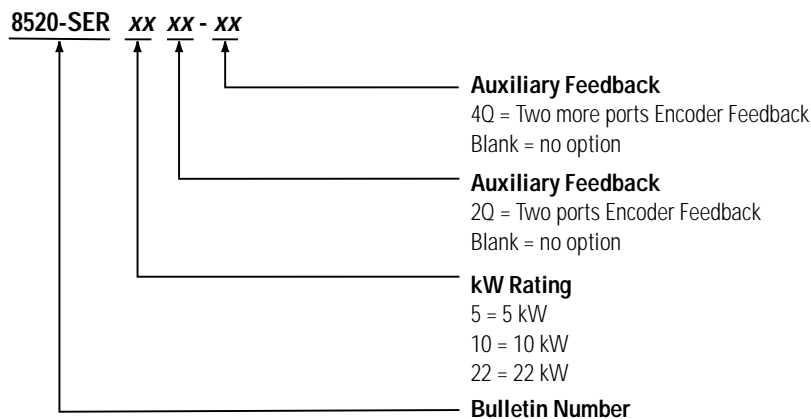
- resolvers, or high-resolution absolute feedback devices
- encoder feedback (for optional position feedback or spindle control)
- two serial ports (for communicating with the 9-Series ODS or other peripherals such as printers or tape readers)
- E-STOP string and status
- spindle outputs
- 9-Series fiber-optic ring connection
- touch probe interface
- remote I/O connection

9/440 System Module (Resolver-based systems) Catalog Number

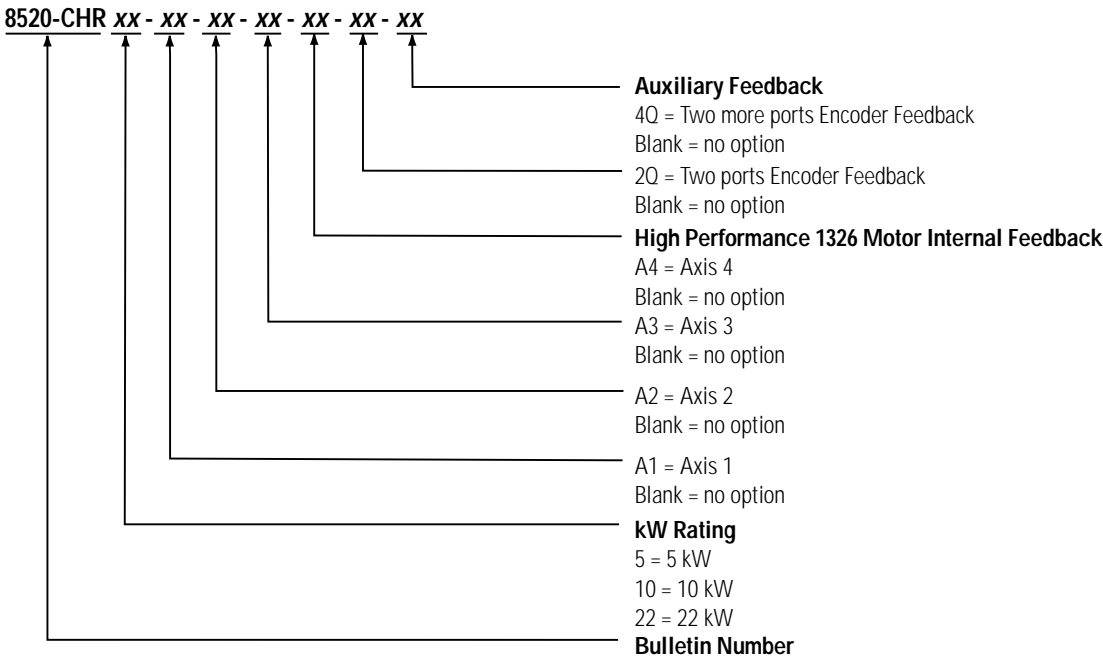


Note: 8520-C (Series C) system modules include Smart Power, improved terminations, and EMI filtering.

CNC Serial Drive System Module Catalog Number



9/440 High Resolution/Absolute CNC System Module Catalog Number

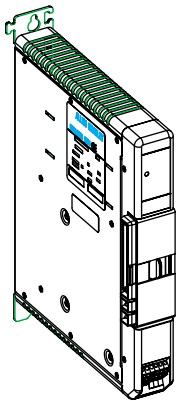


Note: 8520-CHR (Series C) system modules include Smart Power, improved terminations, and EMI filtering.

1394 Axis Modules

Axis modules, with continuous output currents of 3.0, 4.5, 7.5, 23.3 and 35.0A (RMS), convert the DC power supplied by the system module to a variable AC voltage. You need one axis module for every 1326AB/AS or MP-Series servo motor you plan to run using the 1394. Choose each axis module based on the current requirements of the servo motor.

Figure 4.4
1394 Axis Module (1394x-AMxx-xx)



1394 Axis Module Series Information

Axis Module Features	Feature Availability	
	Series C	Series A and B
Cable Clamp (strain relief, shield bond)	Yes	No
EMI filter ¹ (motor brake and thermal circuit)	Yes	No

¹ Voltage rating = 460V AC.

Note: Series A, B and C axis modules are physically interchangeable with each other.

Note: Series A axis modules are not functionally compatible with the 1394C-SJTxx-D system module.

1394 Axis Modules Specifications

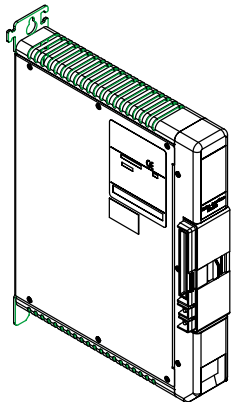
Specification	Axis Modules				
	1394x-AM03	1394x-AM04	1394x-AM07	1394x-AM50 and 1394C-AM50-IH	1394x-AM75 and 1394C-AM75-IH
Speed Regulation ¹	0 to 0.05% of base speed with 100% torque disturbance	0 to 0.05% of base speed with 100% torque disturbance	0 to 0.05% of base speed with 100% torque disturbance	0 to 0.05% of base speed with 100% torque disturbance	0 to 0.05% of base speed with 100% torque disturbance
Static Gain (rms A/mV) ¹	1.28	2.6	4.9	22.8	22.8
Peak Current Limit Adjust	200%	200%	200%	143%	143%
Modulation Frequency	5 kHz \pm 10%	5 kHz \pm 10%	5 kHz \pm 10%	5 kHz \pm 10%	5 kHz \pm 10%
Drift	0.03 rpm/degree C	0.03 rpm/degree C	0.03 rpm/degree C	0.03 rpm/degree C	0.03 rpm/degree C
Nominal Input Voltage	530/680V DC	530/680V DC	530/680V DC	530/680V DC	530/680V DC
Continuous Current (rms)	3.0A	4.5A	7.5A	23.3A	35.0A
Peak Current (rms - 1 second)	6.0A	9.0A	15.0A	33.2A	50.0A
Continuous Power Out 360/460V nominal	1.6/2 kW	2.4/3 kW	4/5 kW	11.34/15.6 kW	17.8/23.8 kW
Efficiency	98%	98%	98%	98%	98%
Weight	5 kg (11.02 lb)	5 kg (11.02 lb)	5 kg (11.02 lb)	7 kg (15.44 lb) (-AM50) 6.73 kg (14.8 lb) (-AM50-IH)	7 kg (15.44 lb) (-AM75) 6.73 kg (14.8 lb) (-AM75-IH)
Capacitance	110 μ F	110 μ F	220 μ F	465 μ F	660 μ F

¹ When used with the controller in the 1394x-SJTxx system module.

1394 Drive Interface Module

The 1394-DIM (Drive Interface Module) provides four channels of analog output, four drive enable outputs, and four drive fault inputs. The 1394-DIM allows the 1394x-SJTxx-C, -T, or -L system module to be used to control any external drive with a $\pm 10\text{V}$ velocity torque reference command and quadrature encoder output. Each 1394-DIM can support up to four drives. However, the maximum number of axes (1394-DIM controlled drives plus 1394x-AMxx axis modules) cannot exceed four per 1394x-SJTxx-C or -T system module and one per 1394C-SJTxx-L system module. The 1394-DIM is not compatible with the 1394x-SJTxx-A, -D, or -E system modules.

Figure 4.5
1394 Drive Interface Module (1394-DIM)



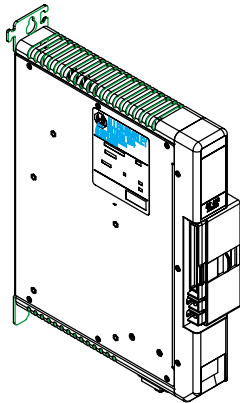
1394 Drive Interface Module Specifications (1394-DIM)

Specifications	Descriptions
Firmware version	<ul style="list-style-type: none"> • 3.7 or higher with 1394x-SJTxx-C-xx and -T-xx systems • 3.9 or higher with 1394C-SJTxx-L-xx systems
Software	GML Commander, version 4.01 or higher
Input voltage	24V, 50 kHz provided by the 1394x-SJT-xx system module
Analog output information (Px-1,2)	
Voltage	0 to $\pm 10\text{V}$ analog
Signal isolation	1500V rms
Resolution	12 bits, 4.88 mV
Impedance	220 ohms
Offset	± 80 mV maximum, compensated to 0 through software setup
Drive OK	15V DC @ 5 mA supplied by the DIM
Drive enable output	30V DC @ 1 A
Operating temperature	0° C to 50° C (32° F to 122° F)
Relative humidity	5-95%
Weight	3 kg (6.6 lb)

1394 DC Link Module

The 1394-DCLM (DC Link Module) provides additional load leveling and energy storage (capacitance) for 1394 systems. This allows additional regenerative energy to be stored during the machine cycle, increasing system capacity, lowering cycle time, and avoiding resistive heat loss. The module can be used alone or two modules can be used to interconnect two 1394 systems using the DC Link cable.

Figure 4.6
1394 DC Link Module (1394-DCLM)



1394 DC Link Module Specifications (1394-DCLM)

Specification	Description
Firmware version	<ul style="list-style-type: none"> • 5.0 or higher with 1394x-SJTxx-A systems • 3.7 or higher with 1394x-SJTxx-C-xx and -T-xx systems • 3.9 or higher with 1394C-SJTxx-L-xx systems
Software	GML Commander, version 4.03 or higher with 1394x-SJTxx-C, -T and -L only
Input voltage	530/680V DC, single phase
Current	Continuous (rms) 32A, Peak (rms - 1 second) 200A
Capacitance	990 μ F
Energy storage	7.36 joules based on a nominal 50V bus delta
Cables available	1394-CPDC-0015 and 1394-CPDC-0030
Cable lengths available	1.5 m (4.92 ft) or 3 m (9.84 ft)
Operating temperature	0° C to 50° C (32° F to 122° F)
Relative humidity	5-95%, non-condensing
Weight	4.8 kg (10.5 lbs)

Note: 1394C-SJTxx-D is not supported by the 1394 DC Link Module.

1394 Axis Module, Drive Interface Module, and DC Link Module Dimensions

Figure 4.7

1394 Axis Module and DC Link Module Front View Dimensions (1394x-AM03, -AM04, -AM07, -DIM, and -DCLM)

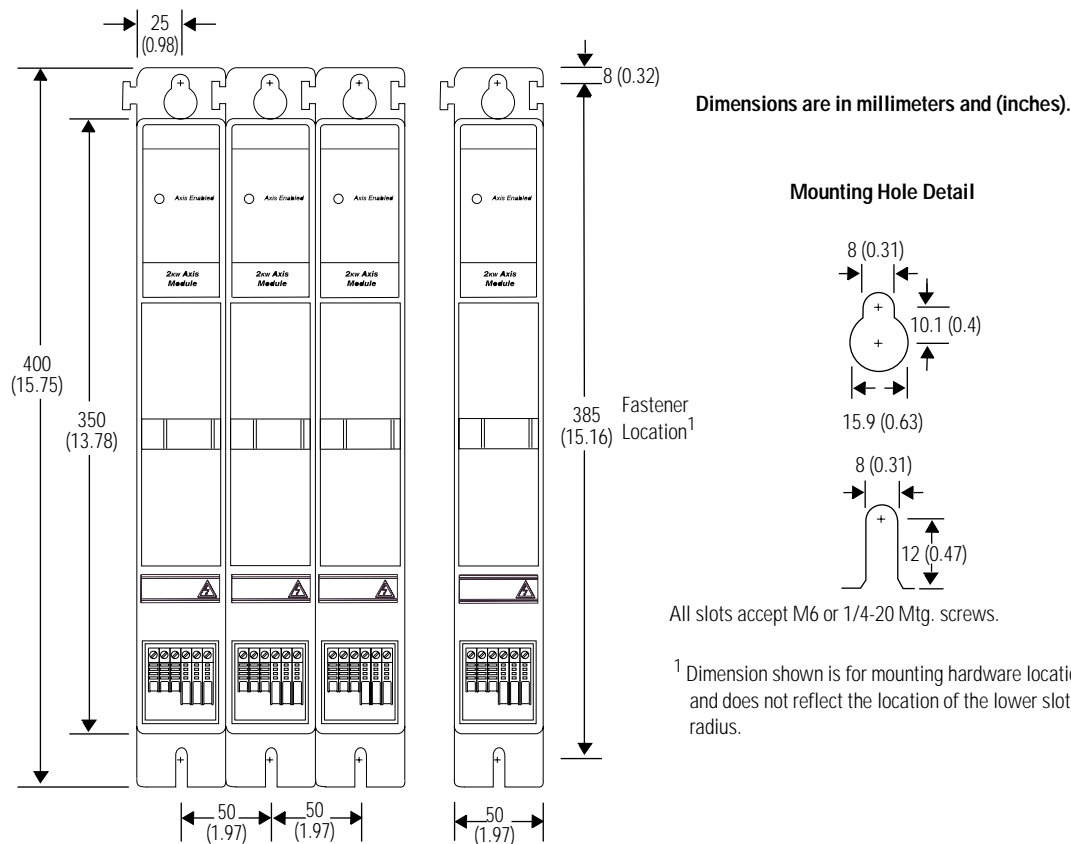


Figure 4.8

1394 Axis Module and DC Link Module Side View Dimensions (1394x-AM03, -AM04, -AM07, -DIM, and -DCLM)

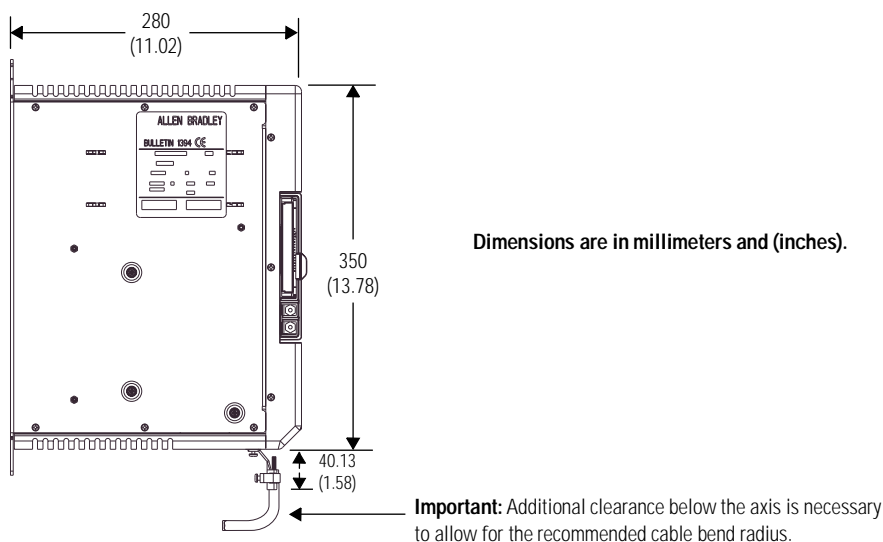


Figure 4.9
1394 Axis Module Front View Dimensions (1394x-AM50, -AM50-IH, -AM75, and -AM75-IH)

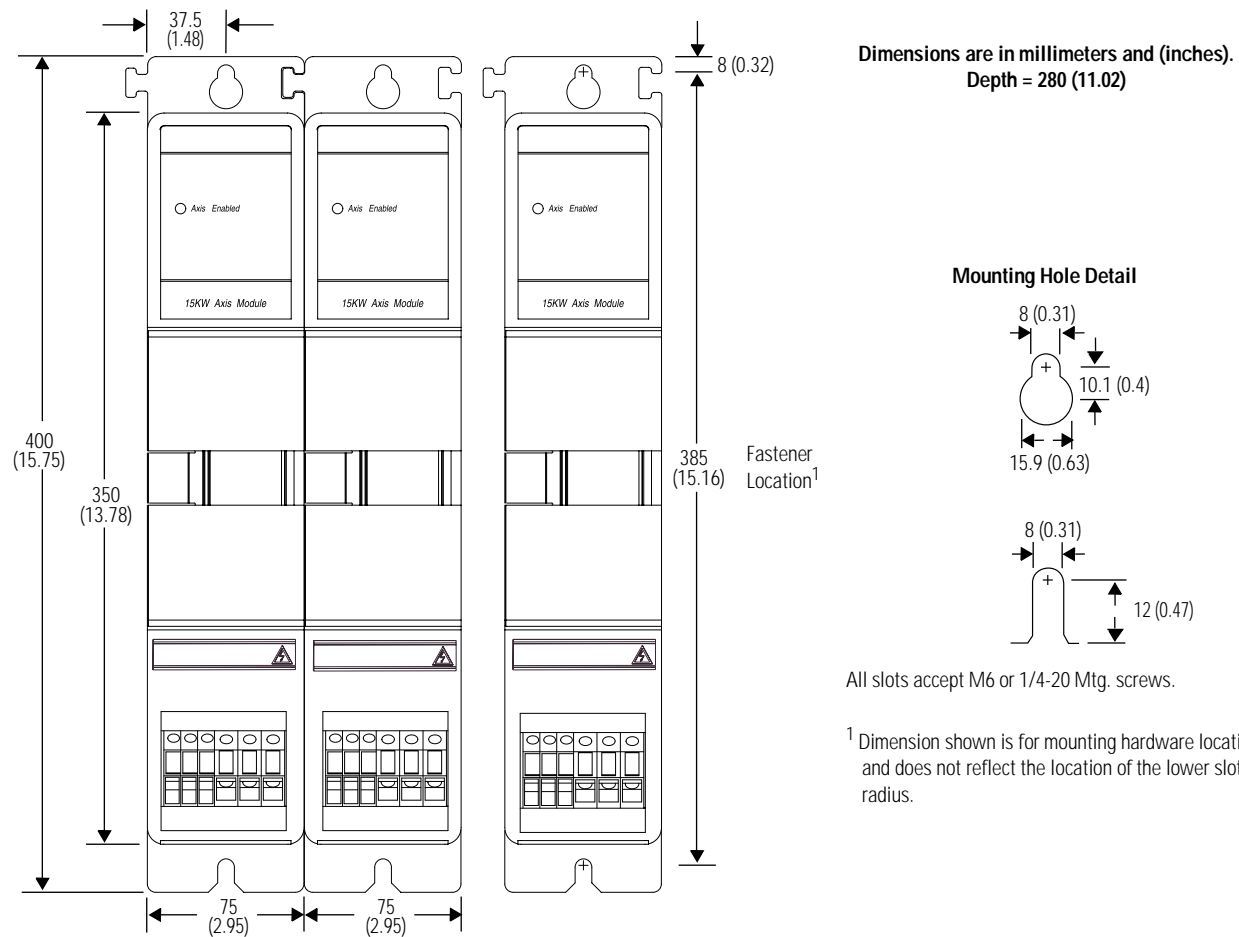


Figure 4.10
1394 Axis Module Side View Dimensions (1394x-AM50 and -AM75)

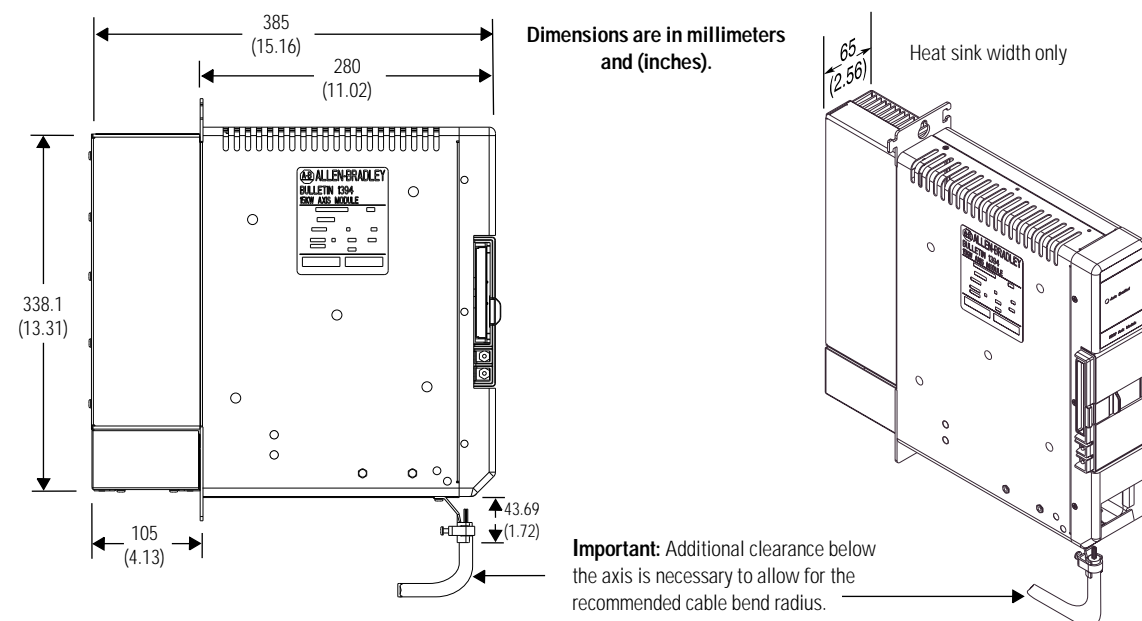
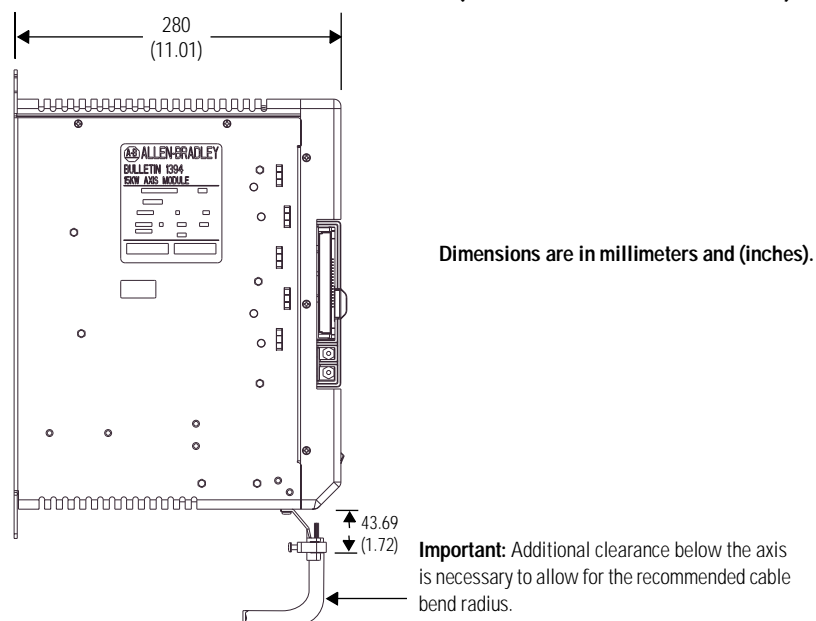
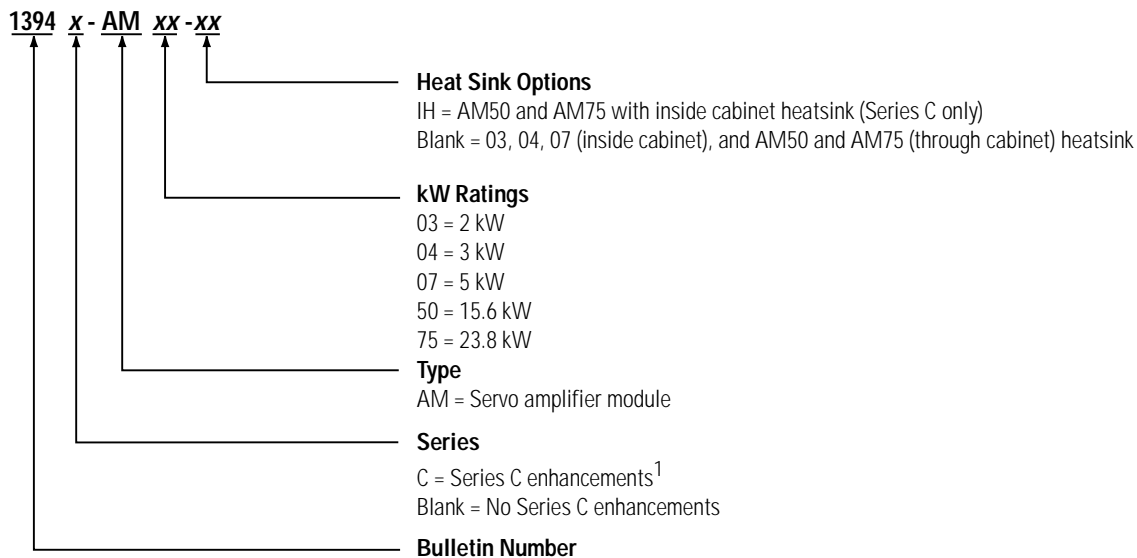


Figure 4.11
1394 Axis Module Side View Dimensions (1394C-AM50-IH and -AM75-IH)



1394 Axis Modules Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering table chart below to understand the configuration of your axis module. For questions regarding product availability, contact your Allen-Bradley distributor.



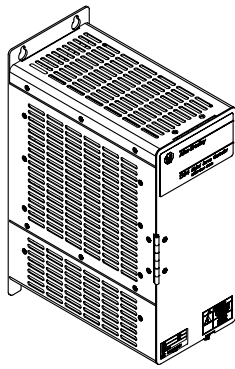
¹ Enhanced axis modules have improved terminations and EMI filtering.

1394 External Shunt Modules

Shunt modules dissipate excess regenerative power. An external shunt resistor kit (1394-SR10A) is available for all 5 and 10 kW systems with regenerative loads that exceed the capacity of the internal 200W shunt resistor. Most 5 and 10 kW systems will not require an external shunt resistor kit.

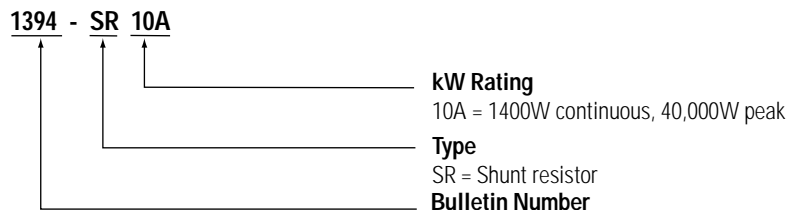
All 22 kW 1394 system modules require an external shunt module (1394-SR9Ax or 1394-SR36Ax). Shunt modules with (rms) power output of 300, 900, 1800 and 3600W continuous, 160,000W peak are available for use with the smart power 22 kW system module. Available in two sizes, each package contains an integral fuse and terminal block. The 3600W package is available with a 115/230V AC cooling fan. Choose your shunt module based on the shunt requirements of the 1326Ax-Bxxxx or MPL-Bxxxx servo motors you plan to run using the 1394.

Figure 4.12
1394 External Shunt Module (1394-SRxxxx)



1394 Shunt Resistor Kit for 5 and 10 kW System Modules Catalog Number

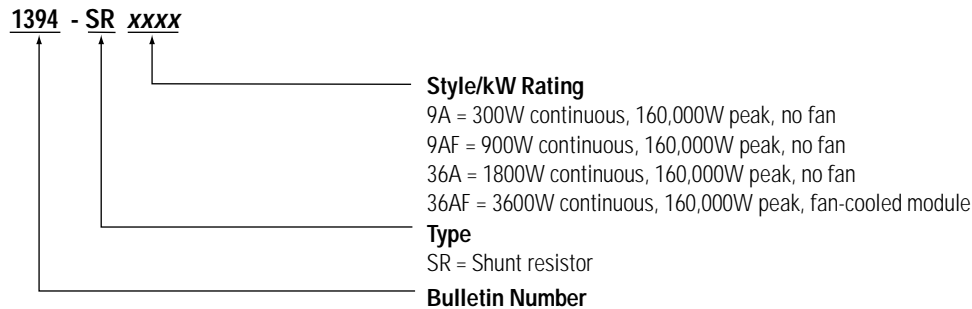
Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering table chart below to understand the configuration of your shunt resistor kit. For questions regarding product availability, contact your Allen-Bradley distributor.



Note: For information regarding specifications and dimensions, refer to Chapter 8, *Motion Control Accessories*.

1394 Shunt Modules for 22 kW System Modules Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering table chart below to understand the configuration of your shunt module. For questions regarding product availability, contact your Allen-Bradley distributor.



Note: For information regarding specifications and dimensions, refer to *Motion Control Accessories*.

1394 Drive System Family Architectural Overview

The following section provides an overview of the architectures for the 1394 GMC Standard (1394x-SJTxx-C and -L) and Turbo Systems, 1394 SERCOS interface system, 1394 9/Series CNC Interface System and 1394 Analog servo system.

1394 GMC System

The 1394 GMC System provides all the functionality of the IMC S Class Compact Motion Controller and power conversion within the 1394 system module. Allen-Bradley offers two versions of the 1394 GMC system module (Standard GMC and GMC Turbo). Both systems are completely programmed and commissioned using GML™ (Graphical Motion Control Language), offer Allen-Bradley DH485, RS-232, and RS-422 as standard communications, and Remote I/O and AxisLink as communication options.

The 1394x-SJTxx-C (Standard GMC) system supports a combination of axis modules and auxiliary encoder input channels up to but not greater than a total of four. The 1394C-SJTxx-L (Standard GMC) provides the same functionality as the 1394x-SJTxx-C, but supports only one axis module and provides two channels of auxiliary encoder input.

In addition, the 1394x-SJTxx-T (GMC Turbo) provides more GML application program memory and executes the programs more quickly. The 1394x-SJTxx-T offers 64K of memory with a 32-bit processor while the 1394x-SJTxx-C offers 32K of program memory with a 16-bit processor. The 1394x-SJTxx-T also includes a direct, high-speed link to the SLC 5/03™, 5/04™, or 5/05™ that simplifies the programming required to transfer data between the 1394x-SJTxx-T and the SLC™.

Figure 4.13
Two Standard GMC Systems' Architectures (1394x-SJTxx-C and 1394C-SJT-xx-L)

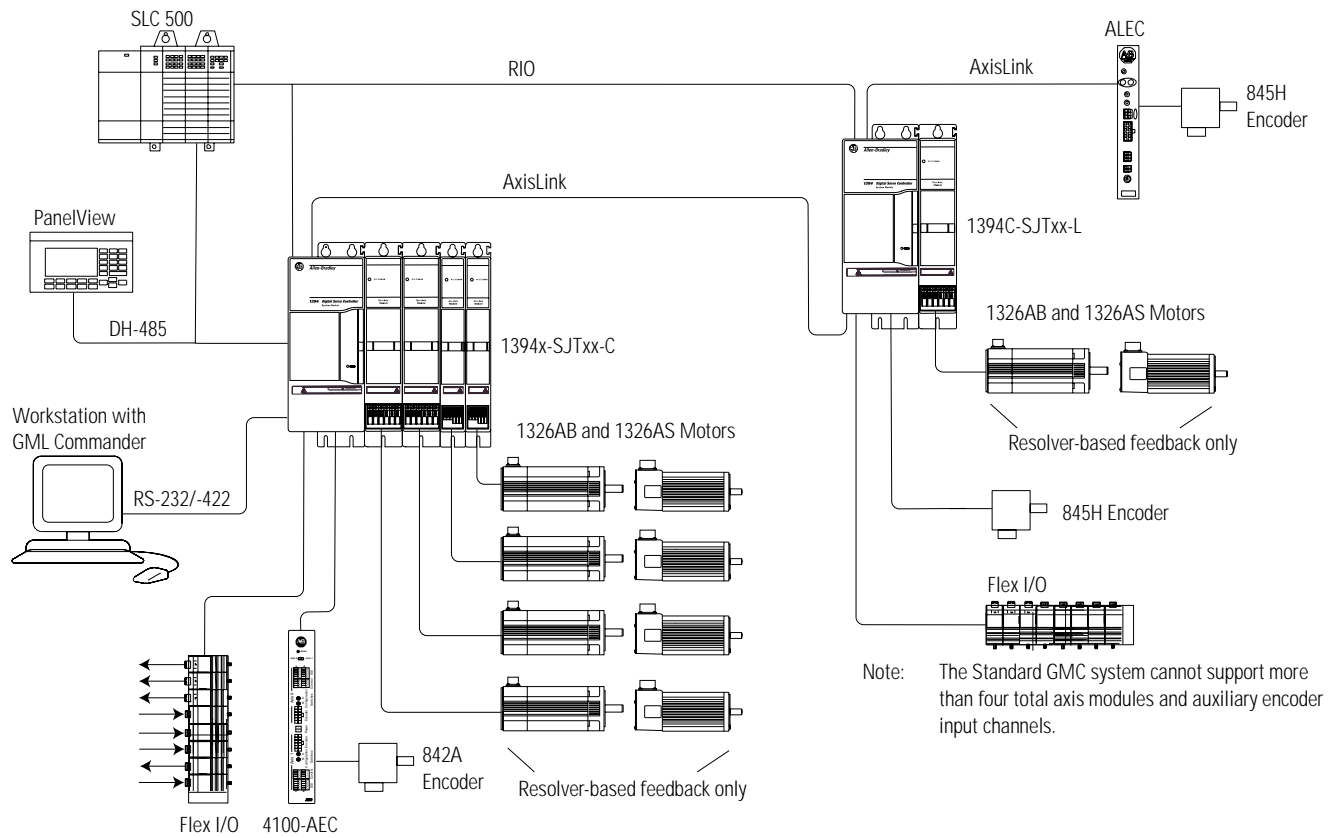
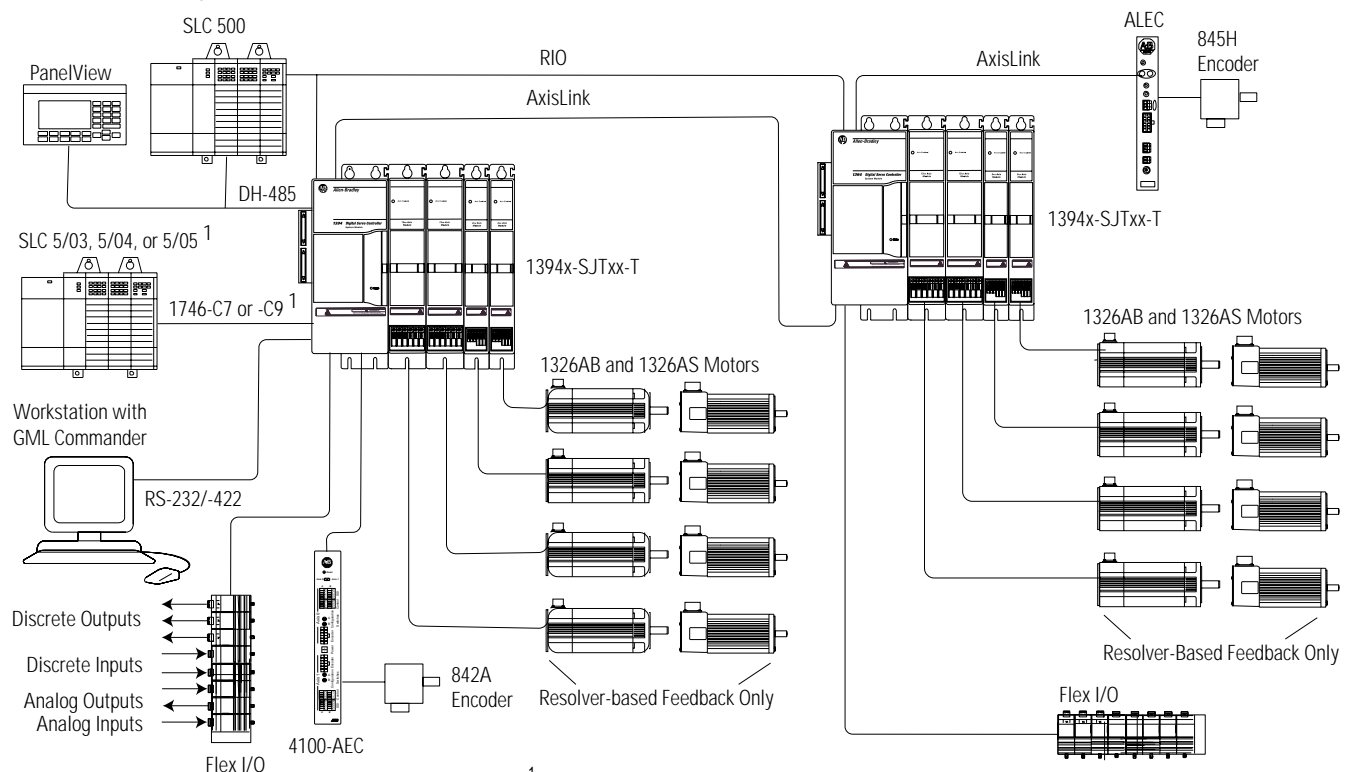


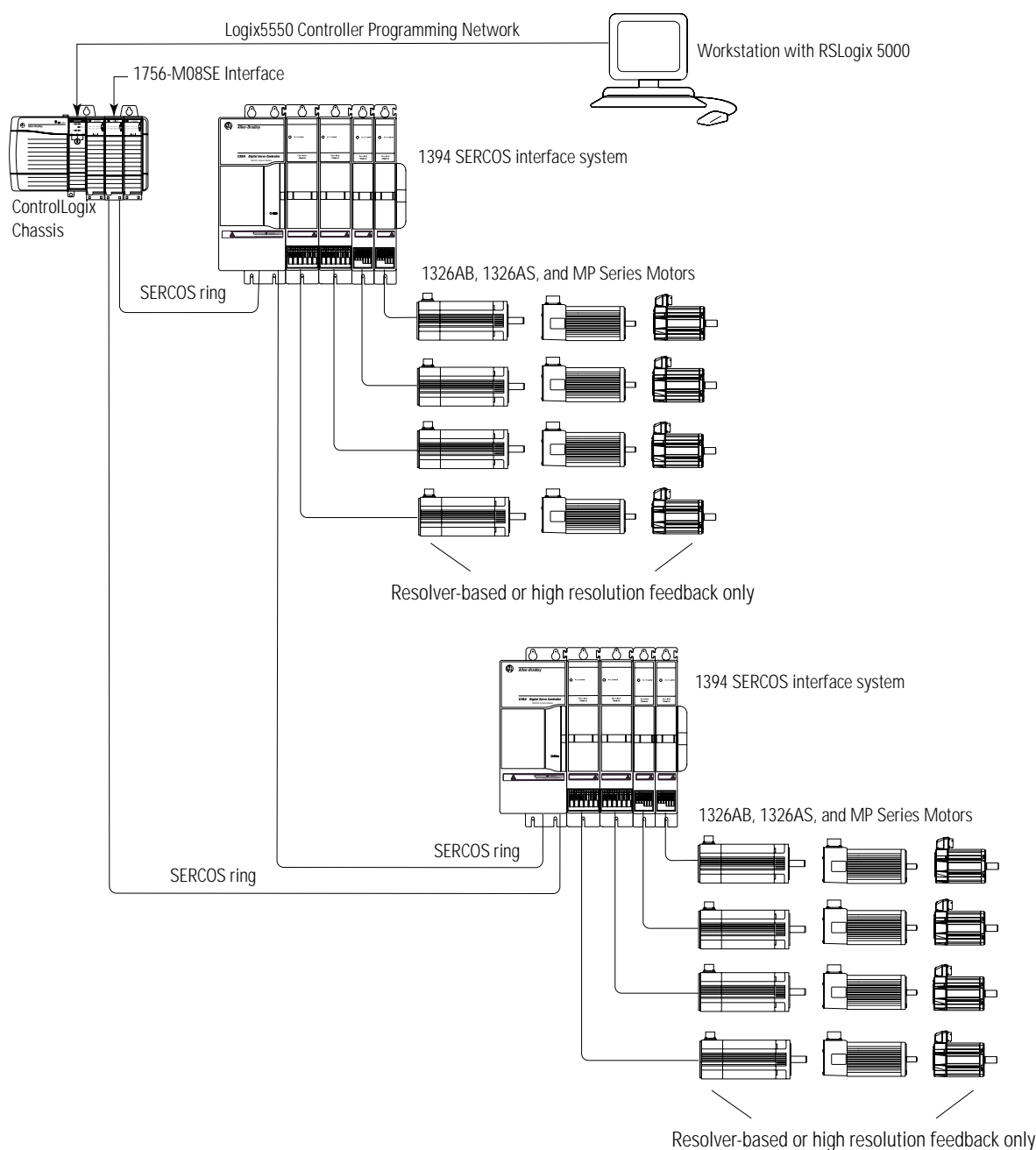
Figure 4.14
Two GMC Turbo Systems' Architectures (1394x-SJTxx-T)



1394 SERCOS Interface System

The 1394 SERCOS interface system module (1394C-SJTxx-D) provides a digital servo drive system with a fiber-optic digital network interface. It can be used as a position, velocity or torque control system and is quickly commissioned with RSLogix 5000 via a ControlLogix processor and SERCOS interface Module (1756-M08SE), which provides access to auto tuning and start-up prompting. The 1394 SERCOS interface system module also offers the Smart Motor interface for automatic motor identification of high resolution feedback and/or absolute position information.

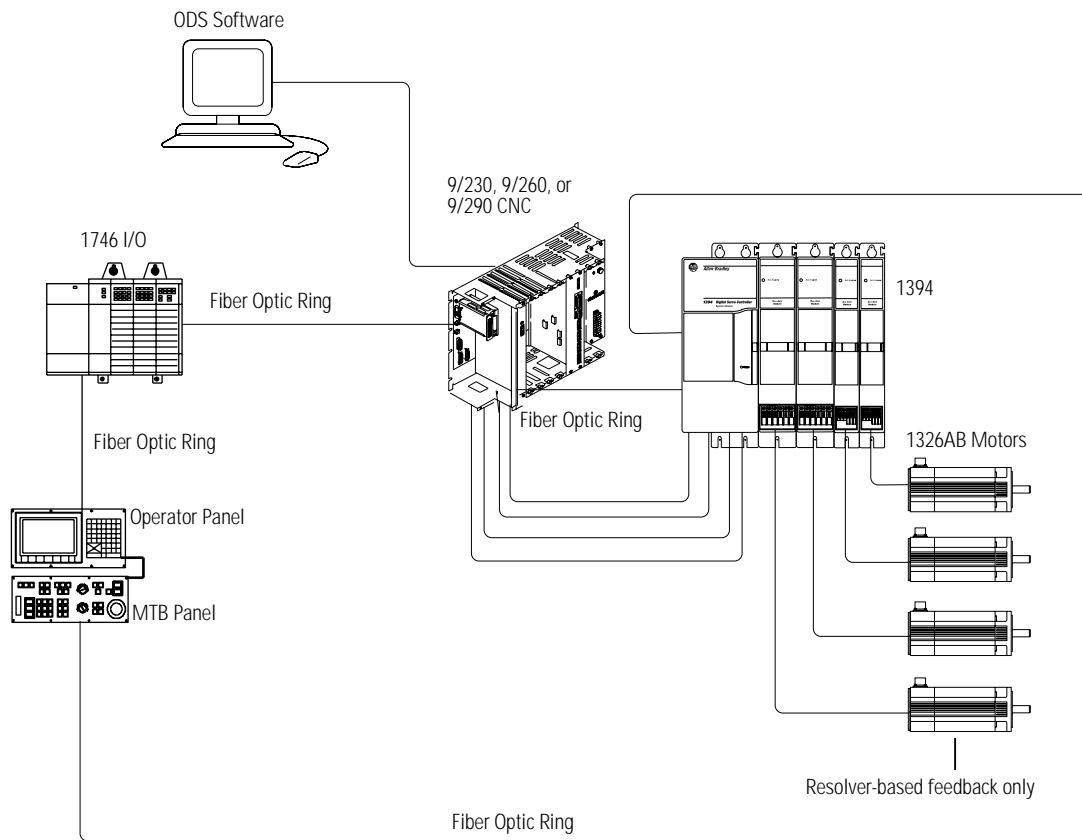
Figure 4.15
1394 SERCOS Interface System Architecture



1394 9/Series CNC Interface System

The 1394 9/Series CNC interface system (1394-SJTxx-E) provides a digital servo system to be used with the 9/260 and 9/290 CNC. This system provides all power electronics and uses a cost-saving digital interface approach. Servo control for this system is handled by the 9/Series CNC. A fiber-optic I/O ring is provided to the 1394 and the system is completely interfaced with and programmed using ODS (Off-Line Development System) and the CNC operator panel. Allen-Bradley Remote I/O, MMS/Ethernet (9/260 and 9/290 only), and Data Highway Plus™ (9/260 and 9/290 only) communications are available options with the 9/Series CNC interface system.

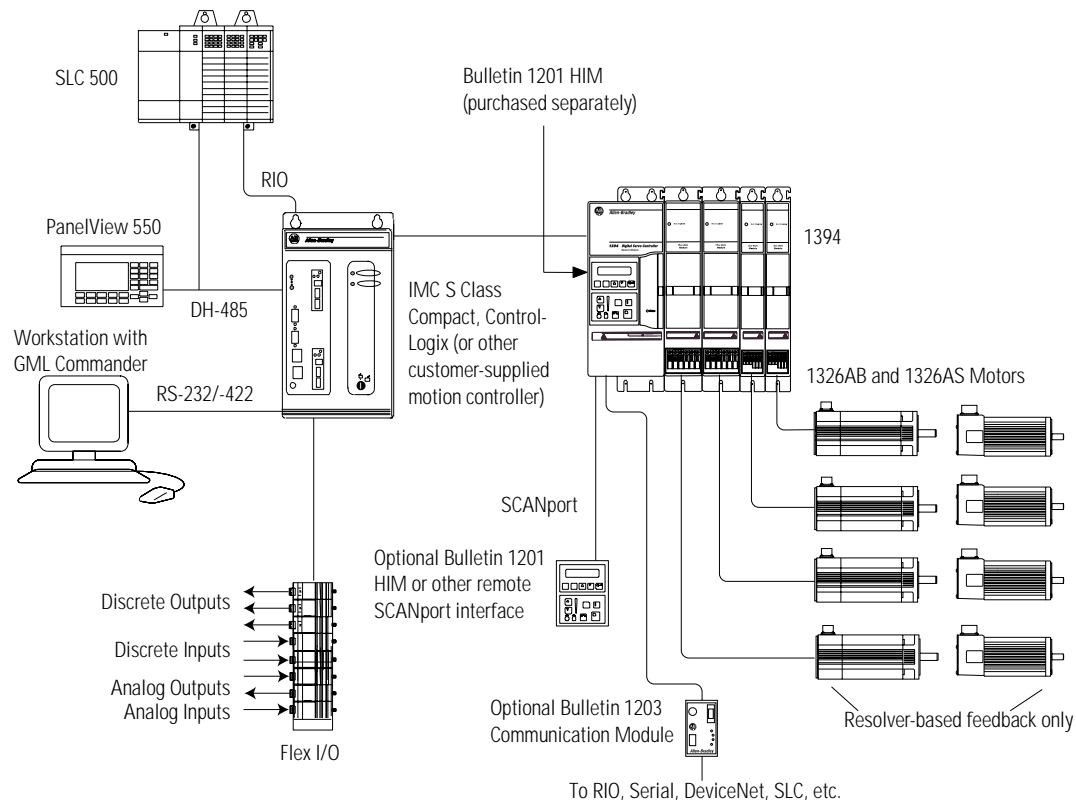
Figure 4.16
1394 CNC Interface System Architecture



1394 Analog Servo System

The 1394 Analog Servo system (1394x-SJTxx-A) provides a digital servo drive system with a traditional $\pm 10\text{V}$ DC analog interface. It can be used as a velocity or torque control system and is quickly commissioned with the Allen-Bradley universal Bulletin 1201 HIM (Human Interface Module), which provides access to auto tuning and start-up prompting. The 1394 also provides a SCANport interface as a standard feature.

Figure 4.17
Analog Servo System Architecture



General System Specifications

The following section contains 1394 environmental, contact, contactors, input fusing, input power, input transformer, power dissipation, and communication specifications.

Environmental Specifications

The following section contains 1394 system environmental specifications.

Specification	Description
Ambient Temperature - System Module	Operation: 0° C to 50° C (32° F to 122° F)
Ambient Temperature - Axis Module	Operation: 1394x-AM03, -AM04, -AM07, -AM50-IH, -AM75-IH (Inside Cabinet) = 0° C to 50° C (32° F to 122° F) 1394-AM50 or -AM75 (Inside Cabinet) = 0° C to 50° C (32° F to 122° F) 1394-AM50 or -AM75 (Outside Cabinet) = 0° C to 40° C (32° F to 104° F) 1394x-SJTxx-x (Inside Cabinet) = 0° C to 50° C (32° F to 122° F)
Relative Humidity	5-95% noncondensing
Altitude	1000 m (3300 ft) - Derate 3% per 300 m (984.3 ft) up to 3000 m (10,000 ft)
Vibration	Operating: 1g Non-operating: 2.5g
Shock	Operating: 15g Non-operating: 30g

Relay Contact Specifications

1394 System		1394 SERCOS Interface System	
Specification	Description	Specification	Description
Drive OK (DROK)	115V AC/24V DC, 1A inductive	Drive System OK	115V AC/24V DC, 1A inductive
Contact Enable Relay		Output 0-3	
Thermal switch		Thermal switch (motor)	

User-Supplied Contactor (M1) Specifications

The following section contains 1394 system user-supplied contactor specifications.

Contactor		1394-SJT05 and -SJT10 (Series A and B)	1394C-SJT05 and -SJT10 (Series C)	1394x-SJT22
Rating		600V AC, 43A ¹	600V AC, 23A	600V AC, 37A
Recommended types:	AC Coil Operation	Allen-Bradley 100-C43x10 ^{2,3}	Allen-Bradley 100-C23x10 ^{2,3}	Allen-Bradley 100-C37x10 ^{2,3}
	DC Coil Operation	Allen-Bradley 100-C43Zx10 ²	Allen-Bradley 100-C23Zx10 ²	Allen-Bradley 100-C37Zx10 ²

¹ Consider using a 60A contactor when the total capacitance of the axis modules is greater than 880 µF.

² x indicates coil voltage.

³ A surge suppressor is required.

User-Supplied Input Fusing Specifications

The following section contains user-supplied input fusing specifications for the 1394 system and 1394 SERCOS interface system.

System		Fuse Description	Rating
1394-SJT05 systems	Series A and B	Bussmann FRS-R-20A or equivalent	600V AC, 20A
1394C-SJT05 systems	Series C	Bussmann KTK-R-20 or equivalent	600V AC, 20A
		Bussmann LPJ-SP 20 or equivalent	600V AC, 20A
1394-SJT10 systems	Series A and B	Bussmann FRS-R-30A or equivalent	600V AC, 30A
1394C-SJT10 systems	Series C	Bussmann KTK-R-30 or equivalent	600V AC, 30A
		Bussmann LPJ-SP 30 or equivalent	600V AC, 30A
1394x-SJT22 systems		Bussmann FRS-R-35 or equivalent	600V AC, 35A
		Bussmann LPS-RK-SP 40 or equivalent	600V AC, 40A
		Bussmann LPJ-SP 45 or equivalent	600V AC, 45A

User-Supplied 24V Logic Input Power Specifications

The following section contains user-supplied 24V logic input power for the 1394 system and 1394 SERCOS interface system.

Specifications				
24V Logic Input Voltage	Frequency	Current		Recommended Fuse
		Axis	Maximum User-Supplied Power Supply	
19-28V AC RMS, single phase	50/60 Hz	1 axis	3.5A	Bussmann MDA-15 or equivalent
		2 axis	4.4A	
		3 axis	5.2A	
18.75-31.25V DC		4 axis	6.0A	

Note: The power supply must be rated for 15A or greater inrush current upon power up.

Input Transformer Specifications for 24V Control Power

The following section contains 24V input transformer specifications for the 1394 system and 1394 SERCOS interface system.

Specification	Description	
	480V system	360V system
Input volt-amperes	200 to 259 VA	200 to 259 VA
Input voltage	480V RMS	360V RMS
Output voltage	24V RMS	24V RMS
Load regulation	2 to 5%	2 to 5%

Note: If the input volt-amperes is more than 350 VA, adjust the load regulation to make the transformer leakage the same as or greater than the 250 VA transformer with 2% regulation.

1394 System Power Dissipation Specifications

The following section contains the power dissipation characteristics of the 1394 and 1394 SERCOS interface system modules, axis modules, DC Link modules, and internal and external shunt resistors.

IMPORTANT

Use the power dissipation figures shown below to calculate cumulative system heat dissipation to ensure that the ambient temperature inside the enclosure does not exceed 50° C (122° F). To calculate total power dissipation, add the dissipation of the system module to the dissipation of the axis module(s).

System Modules

Percentage of Rated Power Output	Power Dissipation Watts		
	1394x-SJT05-x	1394x-SJT10-x	1394x-SJT22-x
20	66	70	100
40	70	77	150
60	73	84	200
80	77	81	250
100	80	98	300

Axis Modules

Percentage of Rated Power Output	Power Dissipation Watts								
	Total					Inside Cabinet		Outside Cabinet	
	AM03	AM04	AM07	AM50 ¹ and AM50-IH ²	AM75 ¹ and AM75-IH ²	AM50 ¹	AM75 ¹	AM50 ¹	AM75 ¹
20	24	27	33	56	85	18	18	38	67
40	30	36	48	95	145	18	18	77	127
60	36	45	63	139	212	18	18	138	194
80	42	54	78	183	279	18	18	165	261
100	48	63	93	227	346	18	18	209	324

¹ The AM50/75 are designed to mount with the rear heat sink extended outside the customer-supplied enclosure. If the modules are mounted entirely inside the customer supplied enclosure, the full power dissipation is inside the cabinet (the sum of the inside/outside columns).

² The AM50/75-IH are designed to mount entirely inside the customer-supplied enclosure.

DC Link Module

Specification	Power Dissipation Watts
DC link module rating	4.225

Internal Shunt Resistor for the 5 and 10 kW System

Note: When the shunt resistor inside a system module (1394~~x~~-SJT05-D, 1394C-SJT05-D, 1394~~x~~-SJT10-D, 1394C-SJT10-D) is active, some additional power will be dissipated at the system module. Its maximum dissipation is 200W. Most applications will use less than 10% of this capacity.

Specification	Description
Internal shunt resistor rating	200W continuous, 40,000W peak (two second maximum on time)
Internal shunt resistor resistance	16 ohms

External Shunt Resistor Kit for 5 and 10 kW Systems

Specification	Description
External shunt resistor rating	1400W continuous, 40,000W peak (two second maximum on time)
External shunt resistor resistance	16 ohms

Note: Use fuse replacement kit (1394-SR10A-FUSE-A) when replacing the 1394-SR10A shunt fuse.

External Shunt Module for 22 kW Systems

Specification	Description
External shunt resistor rating	300-3,600W continuous, 160,000W peak
External shunt resistor resistance	4 ohms

Miscellaneous Specifications

The following section contains the dedicated discrete I/O specifications for the 1394 SERCOS interface system, as well as the encoder input, dedicated discrete I/O, serial I/O, DH-485, Flex I/O, GMC System, remote I/O adapter, and AxisLink specifications for the 1394 systems modules (1394x-SJTxx-C, -L, -T, -A).

SERCOS Interface System Dedicated Discrete I/O Specifications

Specification	Description
Number of dedicated discrete inputs	24 (6 each for axis 0, 1, 2, and 3)
Dedicated discrete input functions	Home limit switch, positive overtravel limit switch, negative overtravel limit switch, position registration_1 and position registration_2, Enable.
Input type	Optically isolated
Operating voltage	<ul style="list-style-type: none"> 24V DC (nominal) ON state: 17.5-38V DC, 5-15 mA OFF state: <6.9V DC, <1.5 mA leakage
Input impedance	3.5 kohms (resistive) per input
Input response time	20 ms maximum; 1 μ s maximum for position registration inputs

Dedicated Discrete I/O Specifications (1394x-SJTxx-C-xx, -L-xx, and -T-xx)

Specification	Description
Number of dedicated discrete inputs	24 (6 each for axis 0, 1, 2, and 3)
Dedicated discrete input functions	Home limit switch, positive overtravel limit switch, negative overtravel limit switch, 2 position registrations (5V or 24V), and thermal fault.
Input type	Optically isolated
Operating voltage	24V DC, 28V DC maximum or 5V DC nominal; 10V DC maximum for position registration inputs
Input On current	12 mA per input (nominal); 2.5 mA for position registration inputs
Input impedance	2 kohms (resistive) per input; 8.8 kohms (resistive) for 24V position registration inputs.
Input response time	5 ms maximum; 1 μ s maximum for position registration inputs

Dedicated Discrete I/O Specifications (1394x-SJTxx-A-xx)

Specification	Description
Number of dedicated discrete inputs	5
Dedicated discrete input functions	1 Enable, 4 fault resets.
Input type	Optically isolated
Operating voltage	24V DC, 28V DC maximum or 5V DC nominal; 10V DC maximum for position registration inputs
Input On current	12 mA per input (nominal); 2.5 mA for position registration inputs
Input impedance	2 kohms (resistive) per input; 8.8 kohms (resistive) for 24V position registration inputs
Input response time	5 ms maximum

System Module Encoder Input Specifications (1394x-SJTxx-C-xx, -L-xx, and -T-xx)

Specification	Description
Number of encoder inputs	<ul style="list-style-type: none"> 4 (axis 0, 1, 2, and 3) for 1394x-SJTxx-C-xx and -T-xx systems 2 (axis 0 and 1) for 1394C-SJTxx-L-xx systems
Type of encoder input	Incremental AB quadrature; optically isolated, differential with marker channel
Encoder interface IC	AM26LS32 or equivalent
Compatible encoder types	Differential, TTL-level (5V DC) line driver outputs, with or without marker
Decode modes	4 times quadrature, step/direction, count up/count down
Maximum encoder frequency	4,000,000 counts per second (4 MHz). This is equivalent to a channel frequency of 1 MHz in 4x quadrature decode mode.
Input impedance	7 kohms minimum (each input)
Encoder power	5V DC @ 1A, user supplied

Serial I/O Specifications (1394x-SJTxx-C-xx, -L-xx, and -T-xx)

Specification	Description
Number of serial channels	2 (serial port A and serial port B)
Channel type	Optically isolated RS-232 or RS-422; each channel individually configured via internal switch
Information code	ASCII
Baud rate	User-selectable up to 128 kbaud (rs-422); 115.2 kbaud (RS-232)
Number of start bits	One
Number of stop bits	One
Word length	8 bits (7 data bits plus 1 parity bit)
Parity	Space parity transmitted; receive parity ignored (may be mark, space, even, or odd)
Duplex	Full or half (user-selectable)
Data synchronization	XON (control-q)/XOFF (control-s)
Front panel connectors	IBM-PC/AT compatible 9-pin D-type female
RS-422 termination	User-selectable 220 ohm resistor via internal switch

DH-485 Specifications (1394x-SJTxx-C-xx, -L-xx, and -T-xx)

Specification	Description
Number of DH-485 channels	One; replaces serial port B when used
Channel type	Optically isolated half-duplex RS-485
Baud rate	9,600 or 19.2 kbaud (user-selectable)
Front panel connectors	Two RJ-45 jacks (+24V is not provided)
RS-485	User-selectable 220 ohms resistor via internal switch
Node address	User-selectable between 0 and 31 inclusive
Node type	Token-passing master
Accessible data type	<ul style="list-style-type: none"> • One binary file (B3) for up to 16,384 bits • One integer file (N7) for up to 1,024 16-bit values • One floating point file (F8) for up to 512 32-bit values • One ASCII string file (A) for up to 2,048 characters • Nine user-configured files; each can be individually configured as any of the above types or as a BCD file for floating point simulation

Flex I/O Specifications (1394x-SJTxx-C-xx, -L-xx, and -T-xx)

Specification	Description
Maximum number of Flex I/O modules	8
Compatible modules	<ul style="list-style-type: none"> • 1794-IB16; 16 24V DC discrete inputs • 1794-IA8; 8 115V AC discrete inputs • 1794-IE8; 8 current/voltage analog inputs • 1794-OB16; 16 24V DC discrete outputs • 1794-OA8; 8 115V AC discrete outputs • 1794-OE4; 4 current/voltage analog outputs • 1794-IE4XOE2; 4 current/voltage analog inputs and 2 current/voltage analog outputs • 1794-IB10XOB6; discrete combination module • 1794-OW8 relay output module • 1794-IF4I isolated analog input module • 1794-OB16P discrete output (protected)
Interface	Direct; no 1794-ASB or other adapter required

1394 System Specifications (1394x-SJTxx-A-xx)

Specification	Description
Velocity Loop Update	250 μ s
Velocity Loop Bandwidth	60 Hz maximum
Input A/D Sample Rate	250 μ s

Encoder Output Specifications (1394x-SJTxx-A-xx)

Specification	Description
Maximum Velocity Range	0-6000 RPM
Output Type	Optically isolated, differential TTL (SU) line driver
Input Power Required	5V \pm 5%, 1 Amp maximum

GMC System Specifications (1394x-SJTxx-C-xx, -L-xx, and -T-xx)

Specification	Description
Servo loop sample and update rate	250 Hz to 2 kHz for 4 axes
Maximum feedback frequency	4 MHz (4,000,000 feedback counts per second)
Absolute position range	\pm 1,000,000,000 feedback counts for linear axes; infinite number for rotary axes
Absolute position resolution	15 position unit digits or 32 feedback count bits, whichever is less
Speed range	0.00001 feedback counts per servo update to 4,000,000 feedback counts per second
Speed resolution	15 position unit digits or 15 feedback count bits, whichever is less
Acceleration/deceleration range	0.00001 feedback counts per servo update to 4,000,000 feedback counts per second
Acceleration/deceleration resolution	15 position unit digits or 15 feedback count bits, whichever is less
Electronic gearing gear ratio range	0.00001:1 to 9.99999:1 (slave counts:master counts)
Electronic gearing gear ratio resolution	8 position unit digits or 32 feedback count bits
Servo gain resolution	32-bit floating point
Servo output limit range	0 to 100%
Servo gain units	P = proportional gain (counts per millisecond/error count)
	I = integral gain (counts per millisecond/error count)
	V = velocity gain (millivolts/counts per millisecond)
	F = feedforward gain (counts per millisecond/ counts per millisecond)

Remote I/O Adapter Specifications (1394x-SJTxx-C-xx, -L-xx, and -T-xx)

Specification	Description
Baud rate	57.6k, 115.2k, or 230.4k (user-selectable)
Rack address	User-selectable between 0 and 31 decimal
Rack width	User-selectable in quarter-rack increments (1/4, 1/2, 3/4, or full)
Number of discrete I/O bits	<ul style="list-style-type: none"> • 12 dedicated inputs • 12 dedicated outputs • 1/4 rack width with 4 inputs and 4 outputs • 1/2 rack width with 36 inputs and 36 outputs • 3/4 rack width with 68 inputs and 68 outputs • Full rack width with 100 inputs and 100 outputs
Maximum block transfer length	64 words (128 bytes)
Block transfer data types	<ul style="list-style-type: none"> • User variable values • Axis data parameter value • Axis data bit state • Master cam position point values • Master cam time point values • Slave cam position point values • Axis or system variable value
Block transfer data formats	<ul style="list-style-type: none"> • 32-bit (double-word) 2s compliment integer • 16-bit (single-word) 2s compliment integer • 32-bit (8-digit) signed BCD • 32-bit IEEE floating point • Word-swapped 32-bit (double-word) 2s compliment integer • Word-swapped 32-bit (8-digit) signed BCD • Word-swapped 32-bit IEEE floating-point

AxisLink Specifications (1394x-SJTxx-C-xx, -L-xx, and -T-xx)

Specification	Configuration	Description
Baud rate	Standard and extended node configuration	One megabit per second
	Extended length configuration	500 kbits per second
Cable type	Standard and extended node configuration	Allen-Bradley 1770-CD RIO cable (Belden 9463 or equivalent)
	Extended length configuration	Belden 9182, Carol C8014, or equivalent
Cable length	Standard and extended node configuration	25 m (82 ft) maximum. 1 m (3 ft) minimum between controllers.
	Extended length configuration	125 m (410 ft) maximum. 1 m (3 ft) minimum between controllers.
Number of motion controllers	Standard and extended length configurations	8 maximum for a total of 32 possible axes
	Extended node configuration	16 maximum for a total of 64 possible axes
Addressing	Standard and extended length configurations	User-selectable address via rotary selector switch on front panel
	Extended node configuration	User-selectable address via GML
Number of virtual master axis	Standard configuration	4 maximum; 1 per motion controller. Any axis on any motion controller can be a virtual master axis to any other motion controller. Each motion controller can define a total of 2 separate axes on any other motion controllers as virtual master axes, but only one can be active any time. A total of 4 different axes can be active as virtual master axes at any time.
	Extended length and extended node configurations	2 maximum; 1 per motion controller. Any axis on any motion controller can be a virtual master axis to any other motion controller. Each motion controller can define a total of 2 separate axes on any other motion controllers as virtual master axes, but only one can be active any time. A total of two different axes can be active as virtual master axes at any time.
Type of virtual master axes	All configurations	Command and actual. Each virtual master axis may be defined to report its command or actual position.
Slave axes	Standard and extended length configuration	31 maximum total per master axis (3 local + 4 x 7 other motion controllers = 31).
	Extended node configuration	63 maximum total per master axis (3 local + 4 x 15 other motion controllers = 63).
Number of discrete I/O	All configurations	112 inputs maximum and 16 user-defined outputs per motion controller. Any motion controller can read 16 discrete outputs of any other motion controller, giving a maximum of $7 \times 16 = 112$ discrete inputs per motion controller. For extended node configuration, discrete I/O can still only be obtained from a maximum of 7 other controllers (112 inputs maximum), not from all 15 other controllers available in a 16 node maximum extended node configuration.
Discrete I/O response	All configurations	≤ 1 millisecond

Software

The software that you can use to program your motion control application includes RSLogix 5000, Ultraware™, and GML™ Commander. Refer to the following sections for information regarding these three types of programming software.

RSLogix 5000

RSLogix 5000 provides support for programming, commissioning, and maintaining the Logix family of controllers. In addition to providing full sequential support, full motion programming support is provided for ControlLogix and SoftLogix.

RSLogix 5000 features the following motion capabilities:

- Programming - complete axis and drive configuration and motion programming support.
- 32 Motion Instructions - instructions given for the control of the operation of motion controllers.
- Cam/Cam Profile Editor - creation and monitoring of performance profiles by means of a graphical interface.
- Output Cam Editor - creation and maintaining of position-based output by means of a graphical interface.

PC Requirements

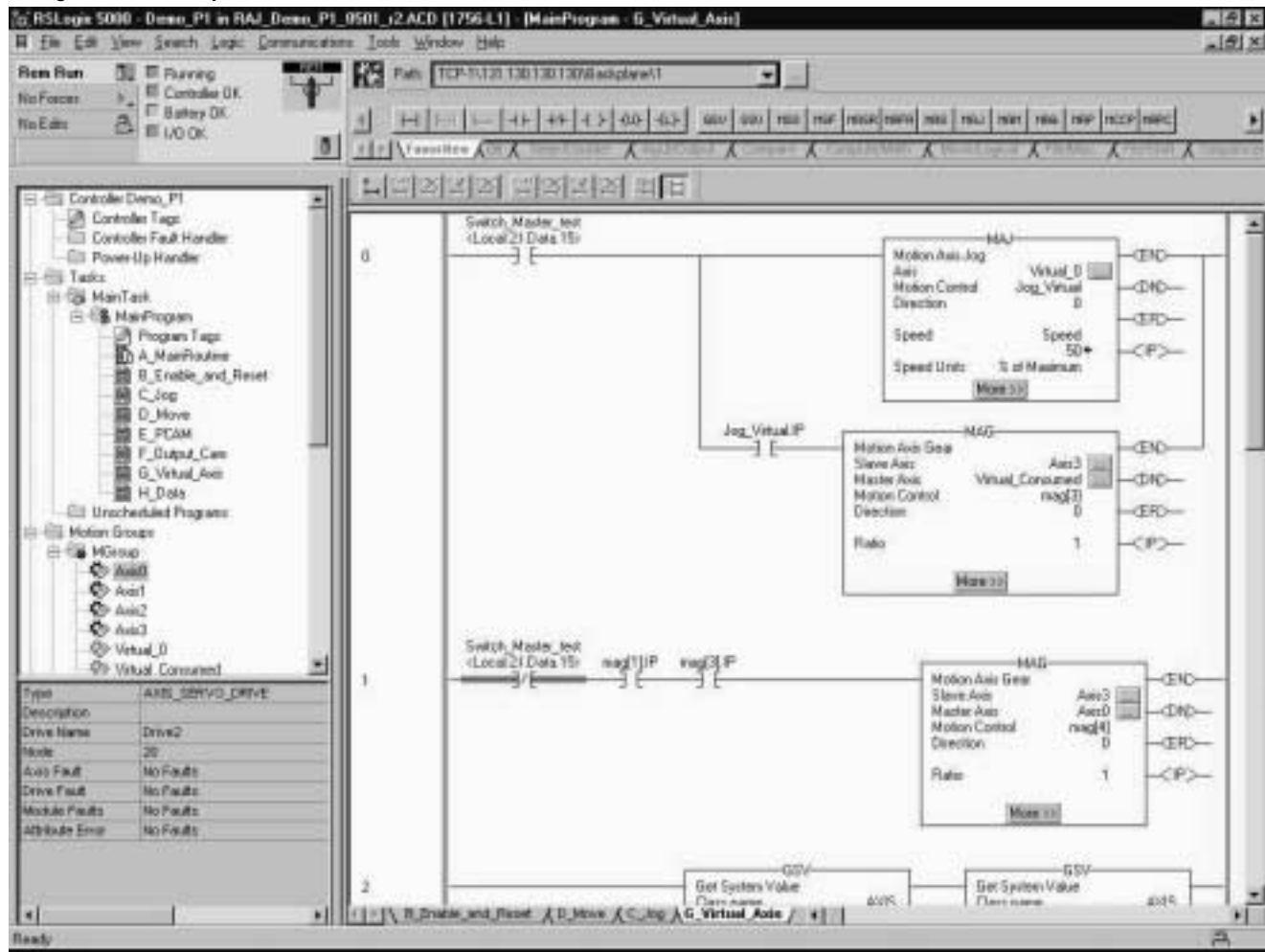
To use RSLogix 5000 software, your personal computer must meet the following requirements:

- Pentium®-based IBM®-compatible with at least 43 MB of hard disk space (or higher depending on application)
- 64 MB of RAM (minimum)
- Microsoft® WindowsNT® (Version 4.0 or higher) or Windows2000®
- VGA monitor

RSLogix 5000 Workspace

RSLogix 5000 allows you to add and configure motion axes and drives and develop ladder-based application programs which include motion commands.

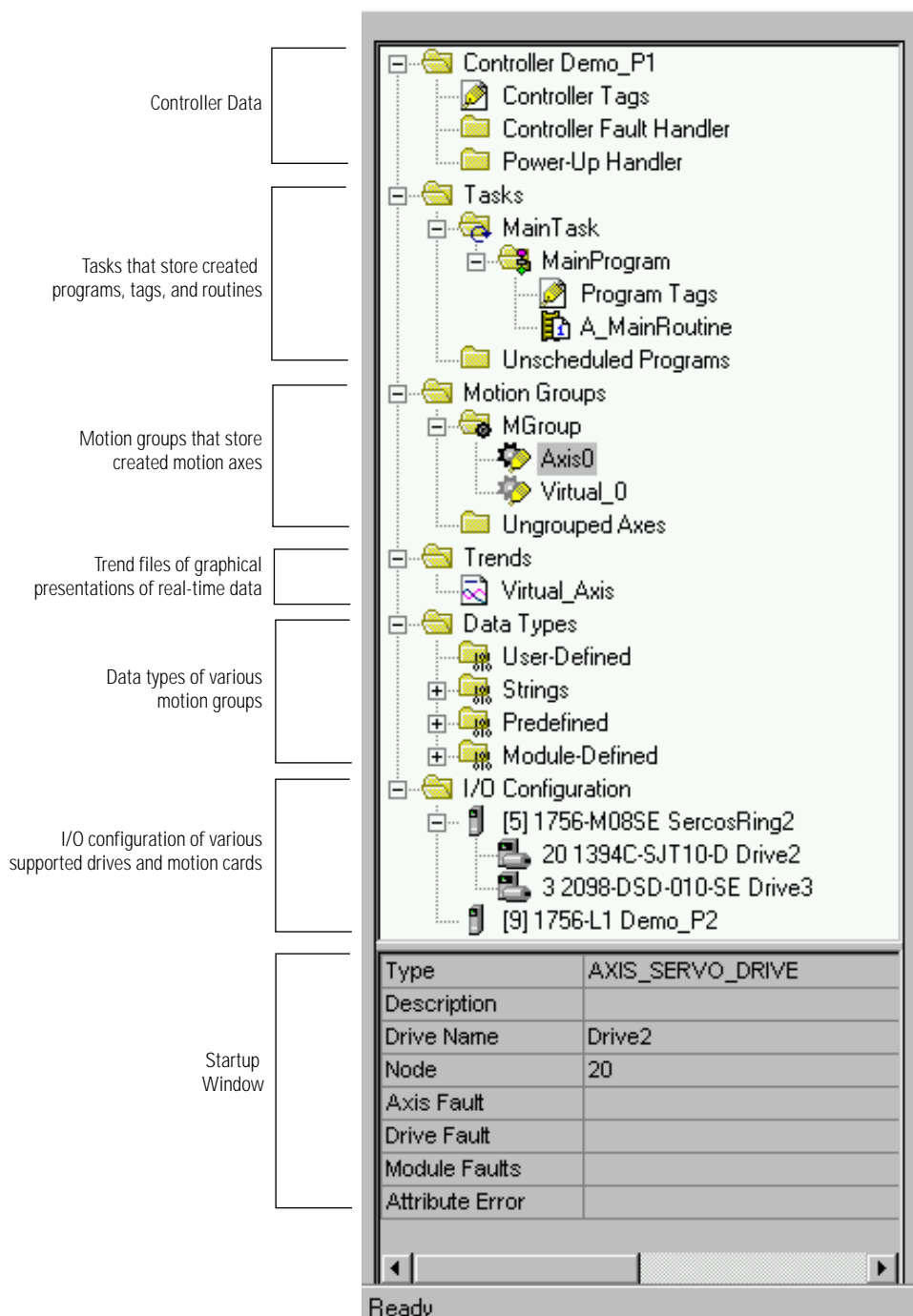
Figure 5.1
RSLogix 5000 Workspace (Version 9.0 or Later)



The RSLogix 5000 workspace contains a control organizer window that supports the creation of tasks, programs, routines, tags, and motion axes. The control organizer also supports I/O configurations that include motion cards and motion drives.

The control organizer window allows you to create up to 32 tasks, 32 programs/task and an unlimited number of routines in a program. Also supported are multiple tag types including boolean, sint, dint, REAL, and one-, two- and three-dimensional groups and structures. You can also create your own user-defined structure.

Figure 5.2
RSLogix 5000 Control Organizer Window



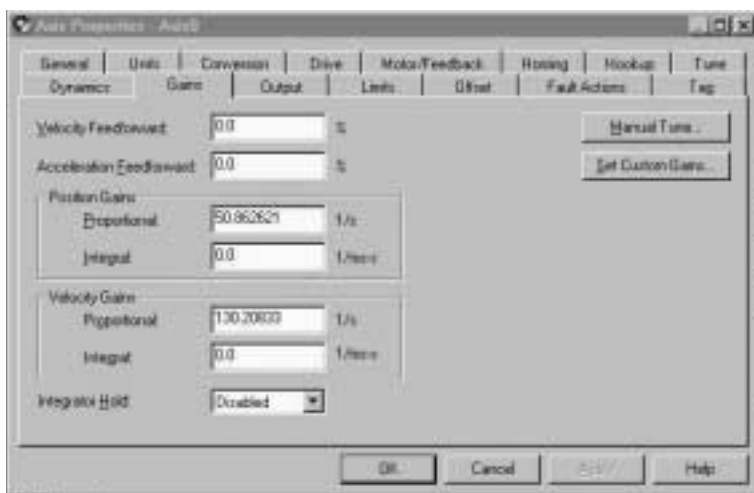
Developing a Motion Control Application Program

With the power of RSLogix 5000 programming software, you can develop a motion control application program by configuring your axis and drive.

Configuring an Axis and Drive

You can configure the your axis and drive as shown below.

Figure 5.3
Configuring an Axis and Drive



Configuring Axis Gains

You can set the axis velocity, acceleration and position gains, as shown below.

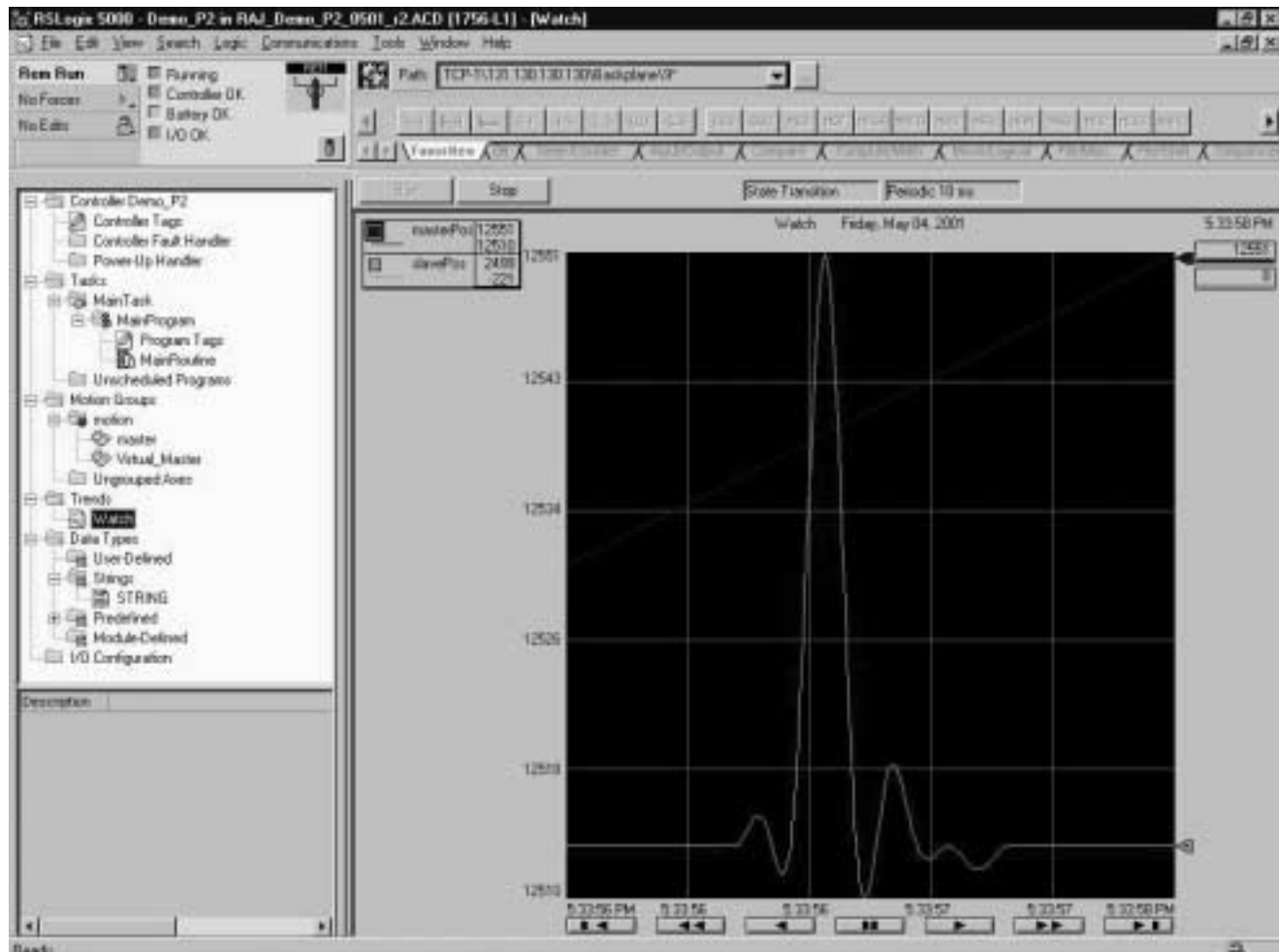
Figure 5.4
Configuring Axis Gains



Viewing Graphical Trends

Once you have created your motion control application program, you can view a real-time presentation of performance data by means of a graphical interface, as shown in Figure 5.5.

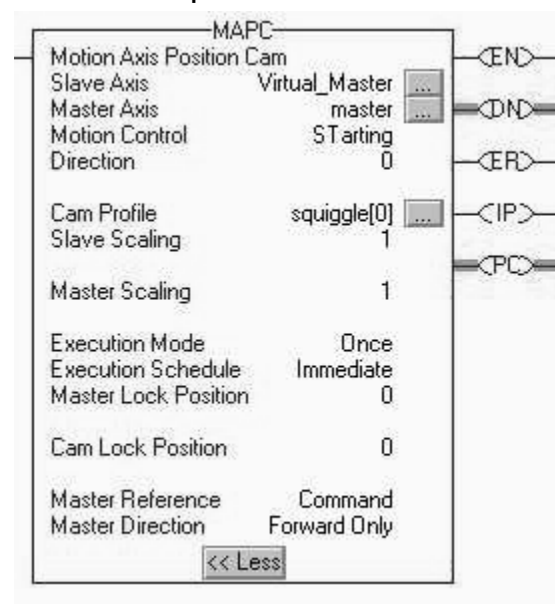
Figure 5.5
Graphical Trending



RSLogix 5000 Instructions

RSLogix 5000 provides X instructions. Included in this are 32 motion instructions that support a wide variety of motion functions., including point-to-point motion, gearing, position camming, time camming, registration, position-based output, and other functions. The instructions can be inserted in directly into the ladder logic application program.

Figure 5.6
Instruction Example



Motion Instructions

The following section contains the motion state, motion move, motion group, motion event and motion configuration instructions.

Motion State Instructions

Command	Required Instruction
Enable the servo drive and activate the axis servo loop	Motion Servo On (MSO)
Disable the servo drive and deactivate the axis servo loop	Motion Servo Off (MSF)
Force an axis into the shutdown operating state	Motion Axis Shutdown (MASD)
Change an axis from an existing shutdown operating state to an axis ready operating state	Motion Axis Shutdown Reset (MASR)
Enable the servo drive and set the servo output voltage of an axis	Motion Direct Drive On (MDO)
Deactivate the servo drive and set the servo output voltage to the output offset voltage	Motion Direct Drive Off (MDF)
Clear all motion faults for an axis	Motion Axis Fault Reset (MAFR)

Motion Move Instructions

Command	Required Instruction
Initiate a controlled stop of any motion process on an axis	Motion Axis Stop (MAS)
Home an axis	Motion Axis Home (MAH)
Initiate a jog motion profile for an axis	Motion Axis Jog (MAJ)
Initiate a move profile for an axis	Motion Axis Move (MAM)
Provide electronic gearing between any two axes	Motion Axis Gearing (MAG)
Change the speed, acceleration rate, or deceleration rate of a move or jog profile in progress	Motion Change Dynamics (MCD)
Change the command or actual position of an axis	Motion Redefine Position (MRP)
Compute a cam profile	Motion Calculate Cam Profile (MCCP)
Initiate a position cam profile	Motion Axis Position Cam (MAPC)
Initiate a time cam profile	Motion Axis Time Cam (MATC)

Motion Group Instructions

Command	Required Instruction
Initiate a stop of motion on a group of axes	Motion Group Stop (MGS)
Initiate a stop of all motion on all the axes in a group, using the method that you set for each axis	Motion Group Program Stop (MGPS)
Force all axes in a group into the shutdown operating state	Motion Group Shutdown (MGSD)
Transition a group of axes from the shutdown operating state to the axis ready operating state	Motion Group Shutdown Reset (MGSR)
Latch the current command and actual position of all axes in a group	Motion Group Strobe Position (MGSP)

Motion Event Instructions

Command	Required Instruction
Arm watch-position event-checking for an axis	Motion Arm Watch (MAW)
Disarm watch-position event-checking for an axis	Motion Disarm Watch (MDW)
Arm servo-module registration-event checking for an axis	Motion Arm Registration (MAR)
Disarm servo-module registration-event checking for an axis	Motion Disarm Registration (MDR)
Arm an Output Cam	Motion Arm Output Cam (MAOC)
Disarm an Output Cam	Motion Disarm Output Cam (MDOC)

Motion Configuration Instructions

Command	Required Instruction
Compute a complete set of servo gains and dynamic limits based on a previously executed MRAT instruction	Motion Apply Axis Tuning (MAAT)
Command the servo module to run a tuning motion profile for an axis	Motion Run Axis Tuning (MRAT)
Apply the results of a previously executed MRHD instruction	Motion Apply Hookup Diagnostics (MAHD)
Command the servo module to run one of three diagnostic tests on an axis	Motion Run Hookup Diagnostics (MRHD)

RSLogix 5000 Ladder Logic Programming

RSLogix 5000 ladder logic programming allows you to control your axes of motion. For example, you can enable, jog and stop your axes with ladder logic programming.

Figure 5.7
RSLogix 5000 Ladder Logic Programming

Rung 0:

Enables the Feed and Cut axes when you press the servo_on button.

Rung 1:

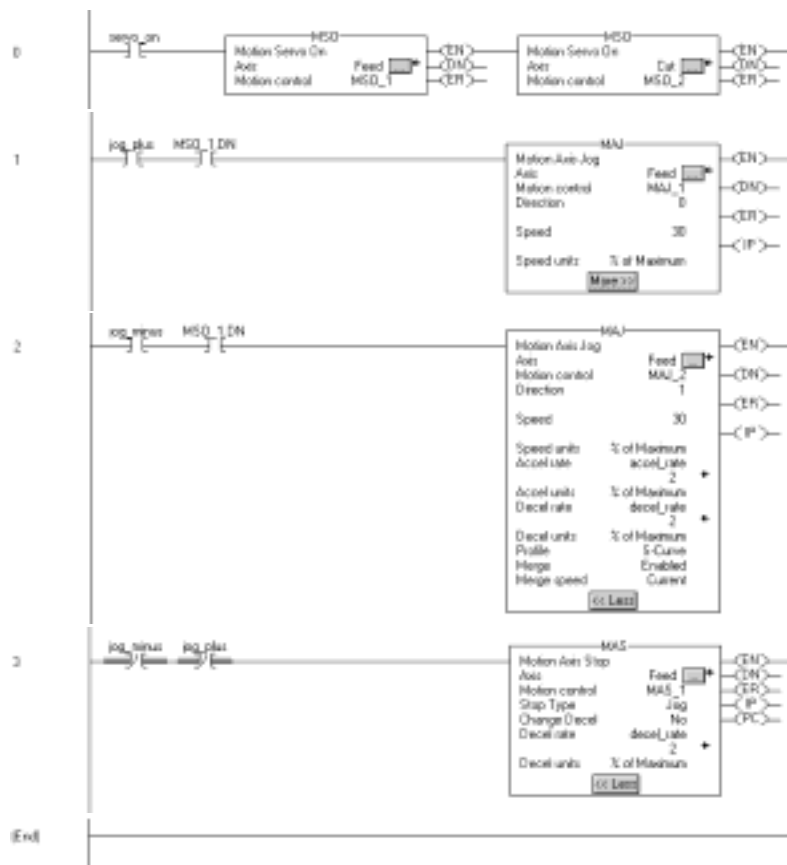
Jogs the Feed axis in the positive direction when you press the jog_plus button, and when the axis “feed” feedback is on.

Rung 2:

Jogs the Feed axis in the reverse direction when you press the jog_minus button, and when the axis “feed” feedback is on.

Rung 3:

Stops the Feed axis when you release the jog_plus button and the jog_minus button.



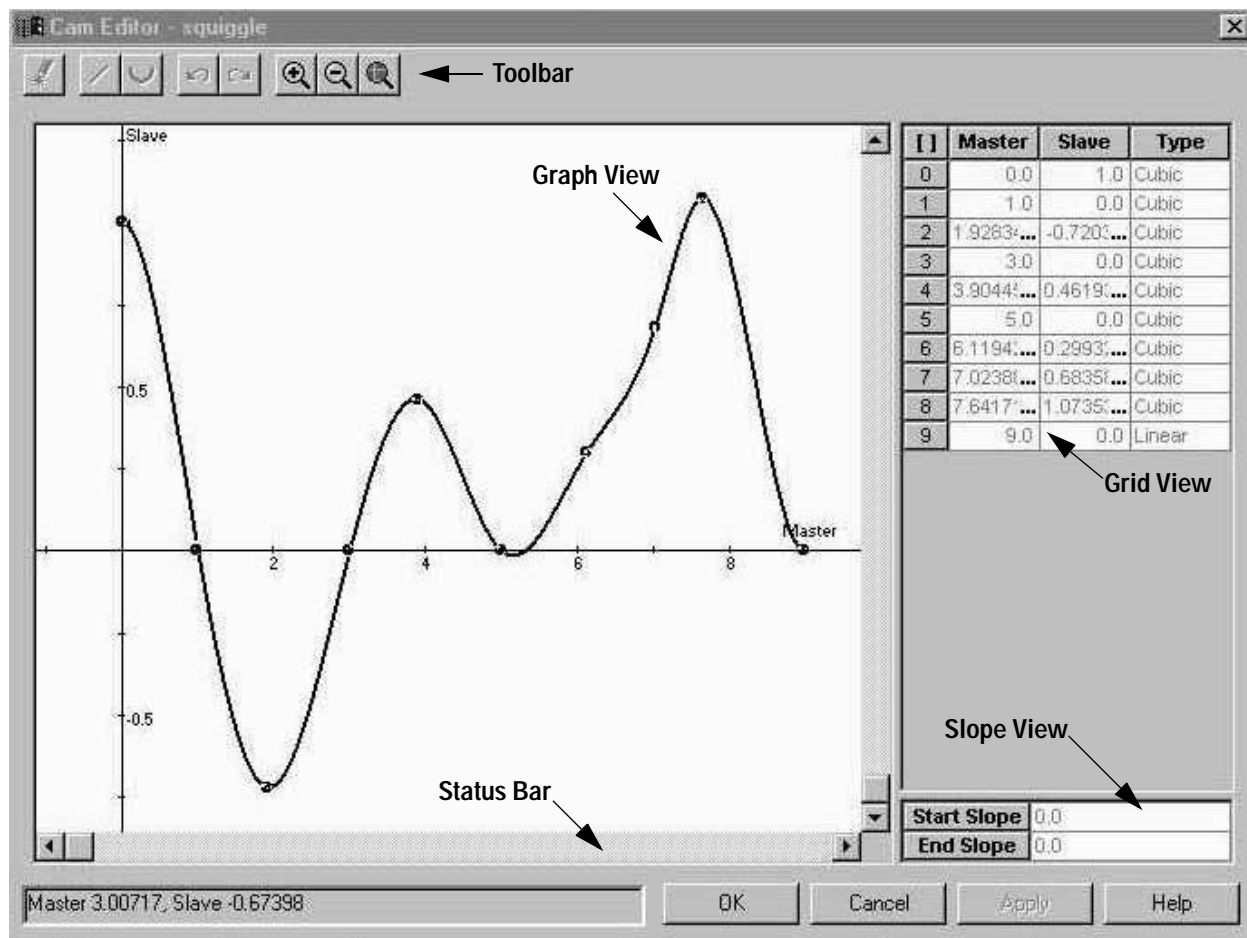
Creating and Editing Motion Application Performance Profiles

The Cam Profile Editor is a graphical user interface within RSLogix 5000 for creating and editing performance profiles (Cam Profiles). You can add cam elements or change existing cam point coordinates in two different views, each of which is a different representation of the same profile. The graph view displays a cam profile as a line graph. The slope view allows you to dictate the starting and ending points of the slope displayed in the graph view. The grid view represents cam profile numerical data.

Cam Profile Editor Workspace

The Cam/Cam Profile Editor workspace is where you create and edit cam profiles and display them in either a graph view, grid view or slope view.

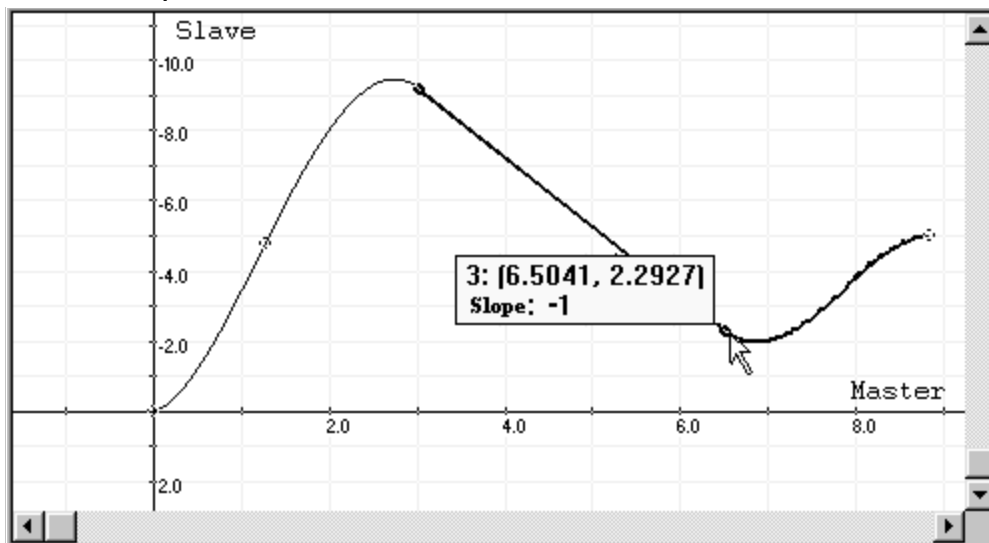
Figure 5.8
Cam Profile Editor



Graph View

The graph view provides a graphical interpretation of a cam profile and allows you to edit the profile. The profile is displayed as cam points (small circles) and cam segments. The cam segments can be either linear or cubic. The graph view also displays a master axis and slave axis with labels that automatically update to a readable size. Scroll bars are provided for navigation. When the mouse pointer is placed over a cam point, an information box is displayed with the cam point information.

Figure 5.9
Cam Editor Graph View



Grid View

The grid view allows you to view and edit the master and slave coordinates of the cam points and the line type of the cam segments. The grid view has three columns labeled: Master, Slave, and Type. The cam element numbers are displayed in the far left column starting with zero. The cam segment type is displayed in the third column. A blank line is always displayed at the bottom of the grid until the last point (the grid is at maximum profile size) is entered. The blank line's disappearance indicates that the grid is full.

Figure 5.10
Grid View

	Master	Slave	Type
0	0	0	Cubic
1	1.268292	4.796747	Cubic
2	3.021138	9.178861	Linear
3	6.504065	2.292682	Cubic
4	8.842276	4.983739	Linear
*			

Slope View

The slope view allows you to verify the starting and ending points of a performance profile. The slope view is also the means by which you can adjust the starting and ending points of your performance profile as displayed in the graph view.

Figure 5.11
Slope View

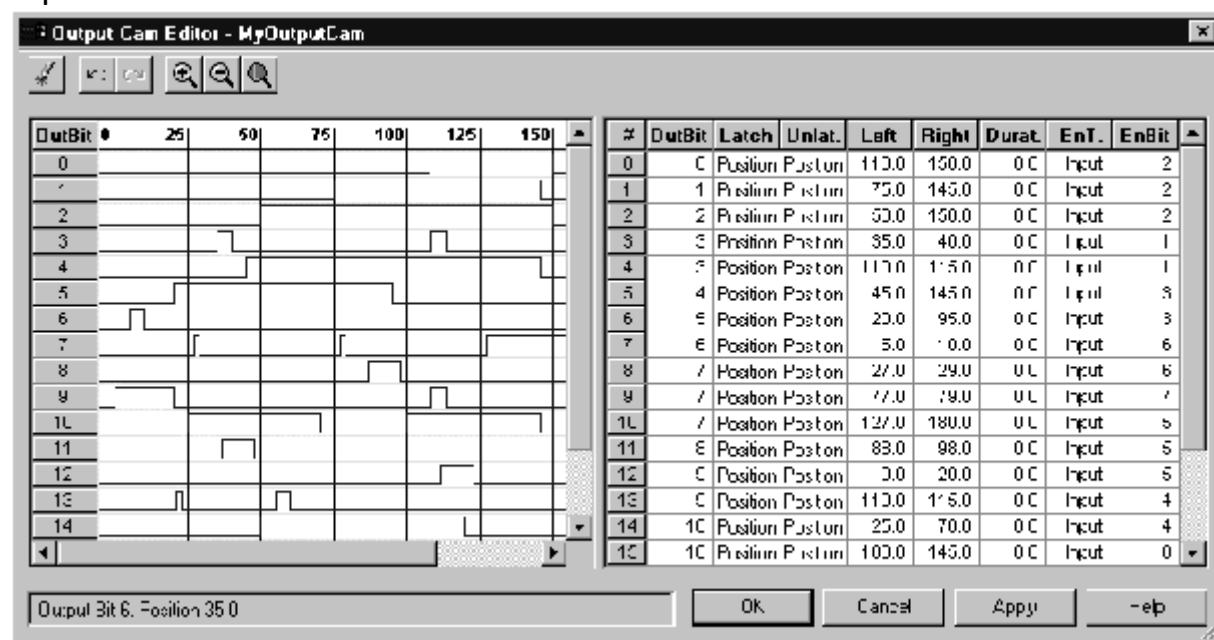
Start Slope	1.00
End Slope	0.00

Editing and Viewing Motion Application Performance Profiles

The Output Cam Editor is an easy-to-use graphical user interface within RSLogix 5000 that you can use to edit and view performance profiles (OUTPUT_CAM arrays). It can be launched from the Data Monitor or Data Editor and from the Motion Arm Output Cam instruction.

The design of the Output Cam Editor is similar to the design of the Cam Editor [3] and consists of two different views and a toolbar. Each view is a different representation of the same OUTPUT_CAM array. The graph view displays the Output Cam profiles as line graphs ordered by output bit. The grid view is a direct representation of the array data. The toolbar provides access to the Insert, Undo, Redo, Zoom-In, Zoom-Out, and Zoom-To-Fit commands.

Figure 5.12
Output Cam Editor



RSLogix 5000 Programming Software Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your software. For questions regarding product availability, contact your Allen-Bradley distributor.

9324 - RLD300ENE

↑ RSLogix5000 Programming Software on CD-ROM
↑ Bulletin Number

Ultraware

Ultraware is used to commission Ultra5000 Intelligent Positioning Drives (IPD) and Ultra3000 Digital Servo Drives (DSD). Ultraware provides a comprehensive array of drive configuration, monitoring, and diagnostic functions, along with an intuitive method to locate the various drive functions and parameters.

Ultraware software features:

- A complete set of troubleshooting and diagnostic tools as well as compatibility with Windows[®] 95, Windows[®] 98, Windows[®] 2000 and WindowsNT.
- Configuration capability that allows commissioning and programming to be done off-line.

Ultra5000 IPD motion programs are written with the flexible C programming language.

The C programming language features:

- Standard ANSI C programming language support for fast code execution and compact programs.
- Color syntax editor that color codes key words and sections for ease of use.
- Convenient ability to add custom functions like rotary knife and smart belt for greater application flexibility.

PC Requirements

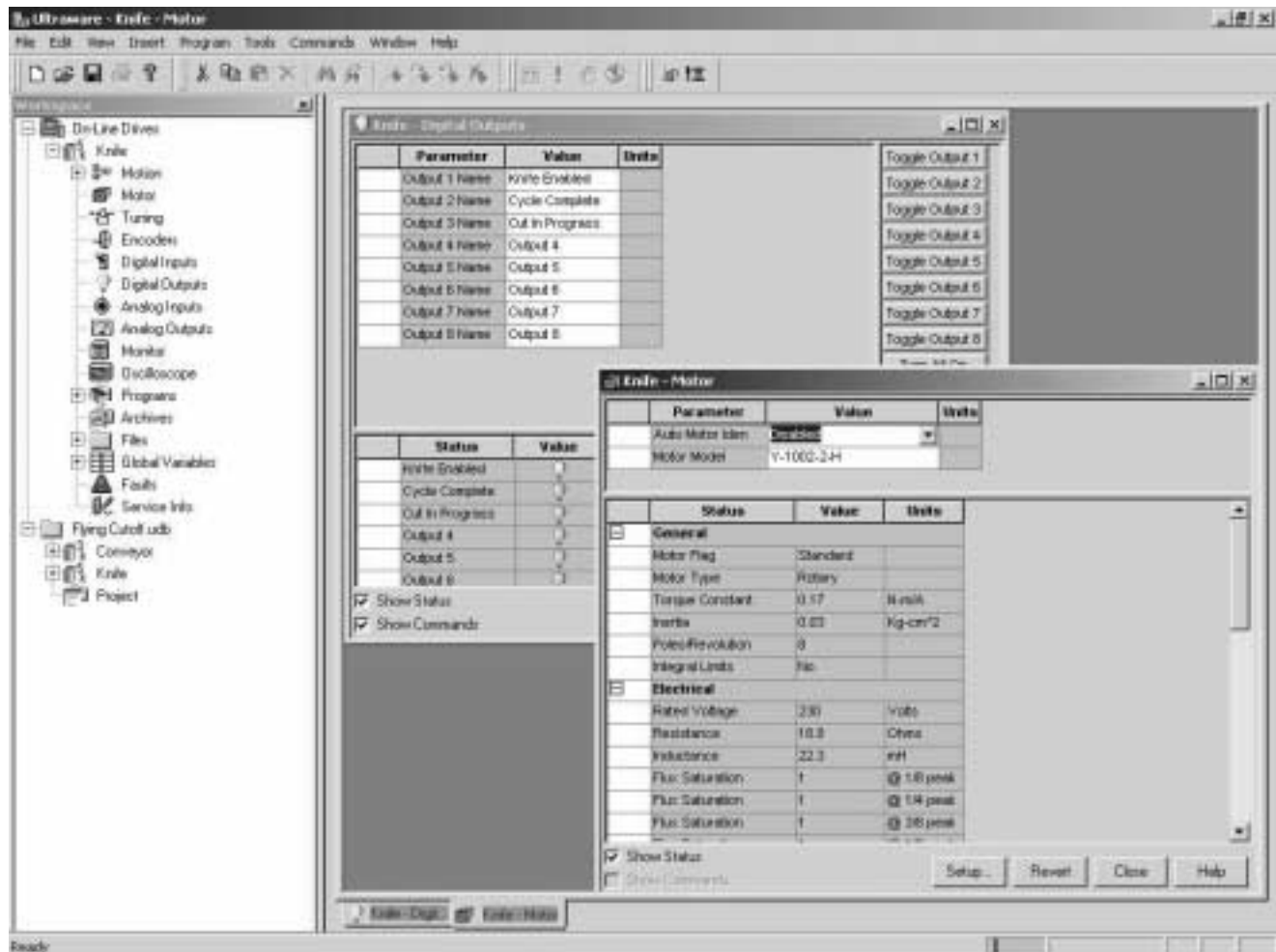
To use Ultraware software, your personal computer must meet the following requirements:

- Pentium-based IBM-compatible with 50 MB of hard disk space
- 24 MB of RAM (minimum)
- Microsoft Windows 95 or higher
- 650 MB CD-Rom drive
- RS-232 serial port
- VGA monitor

Ultraware Drive Set-Up

Ultraware Windows-based software allows you to configure, tune, and monitor Ultra3000 DSD and Ultra5000 IPD. Additionally, Ultraware offers tools that can be used to develop C motion programs for the Ultra5000 IPD. Ultraware allows you to communicate with any combination of 2098 Ultra Family drives over the same RS-232/422/485 serial communications network. All drive parameters are available by double-clicking items in the workspace tree.

Figure 5.13
Ultraware Drive Set-Up Screen



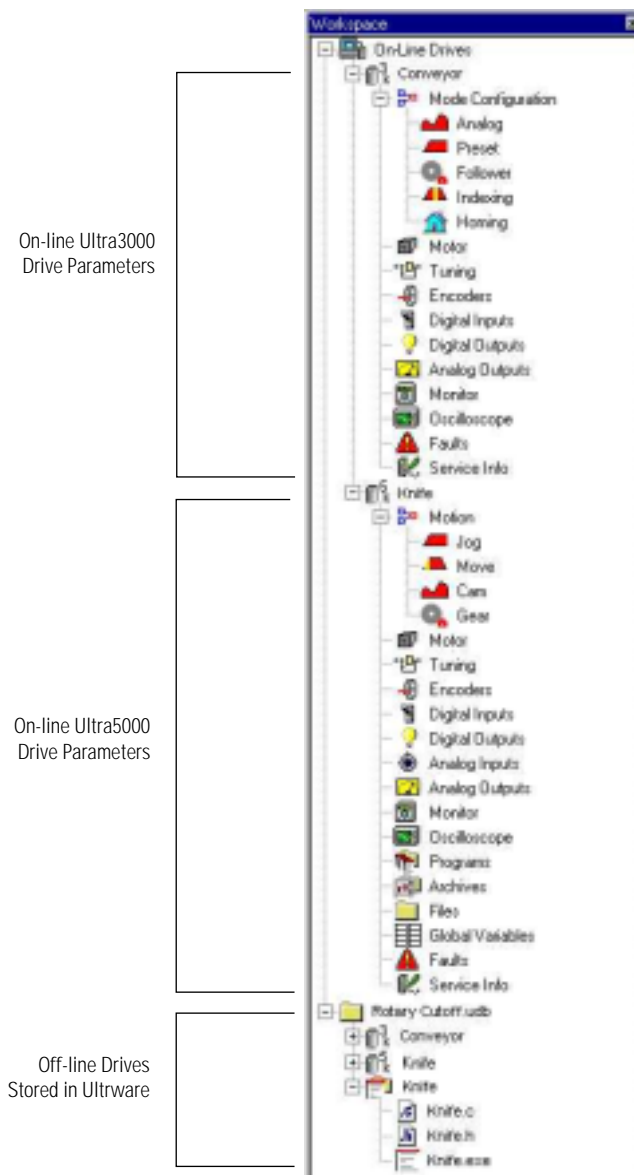
Ultraware Workspace

Ultraware allows you to access on-line and off-line drives, save on-line drive settings, and load off-line drive settings to on-line drives. In the workspace window, each icon provides access to drive information.

The workspace is divided into two sections: on-line drives and an Ultraware file. All drives on the serial network are displayed under the on-line drives icon. All off-line drive settings are stored in the Ultraware file.

Ultraware allows you to load new configurations to on-line drives and save existing settings by performing simple drag-and-drop operations. You can save an existing on-line drive configuration by dragging and dropping the desired drive to the Ultraware file. The same process is used to load off-line drive settings into an on-line drive. To load all off-line settings into the on-line drive, you only need to drag and drop the off-line drive icon onto the desired on-line drive.

Figure 5.14
Ultraware Workspace Window



Ultraware Windows

Ultraware windows allow you to modify and monitor all of the drive parameters and execute commands for a given set of drive attributes. Once you have clicked on one of the icons shown in Figure 5.14, the following dialog box opens.

Figure 5.15
Ultraware Drive Function Window

Parameter	Value	Units
Output 1	In-Position	
Output 2	Drive Enabled	
Output 3	In Dwell	
Output 4	Zero Speed	
Relay	Unassigned	
Brake Active Delay	0	milliseconds
Brake Inactive Delay	0	milliseconds

Status	Value	Units
Output 1 State		
Output 2 State		
Output 3 State		
Output 4 State		
Relay State		

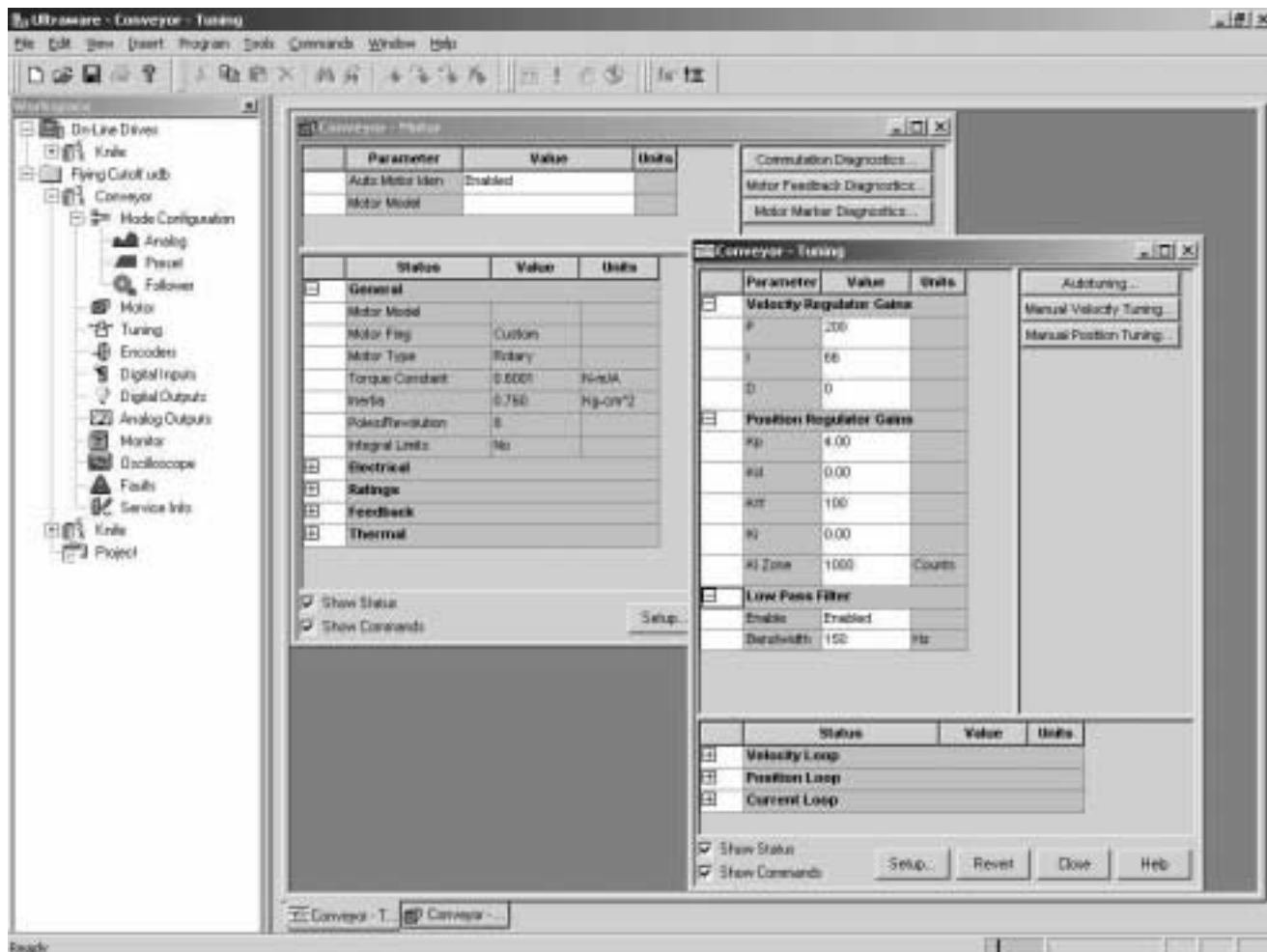
☒ Show Status
☒ Show Commands

Setup... Revert Close Help

Commissioning Ultra3000 and Ultra5000 Drives with Ultraware

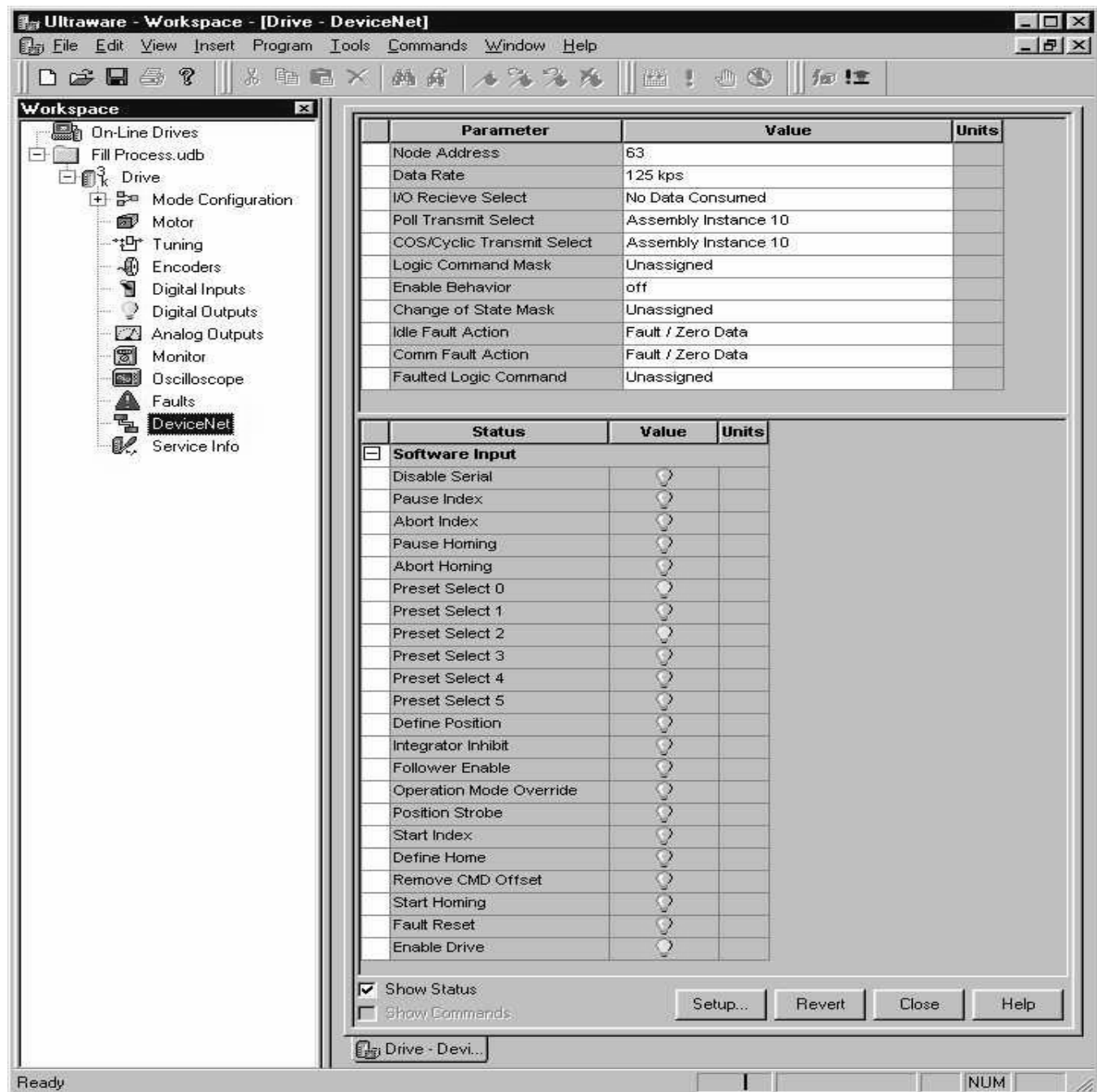
Ultraware provides you with a simple way to configure your Ultra3000 DSD and Ultra5000 IPD. By simply accessing each of the icons under each drive, you can establish all the settings necessary for proper operation.

Figure 5.16
Ultraware Drive Commissioning Screens



You can commission Ultra3000 DSD with the DeviceNet or indexing DeviceNet interfaces as shown below.

Figure 5.17
Commissioning an Ultra3000-DN Digital Servo Drive with Ultraware

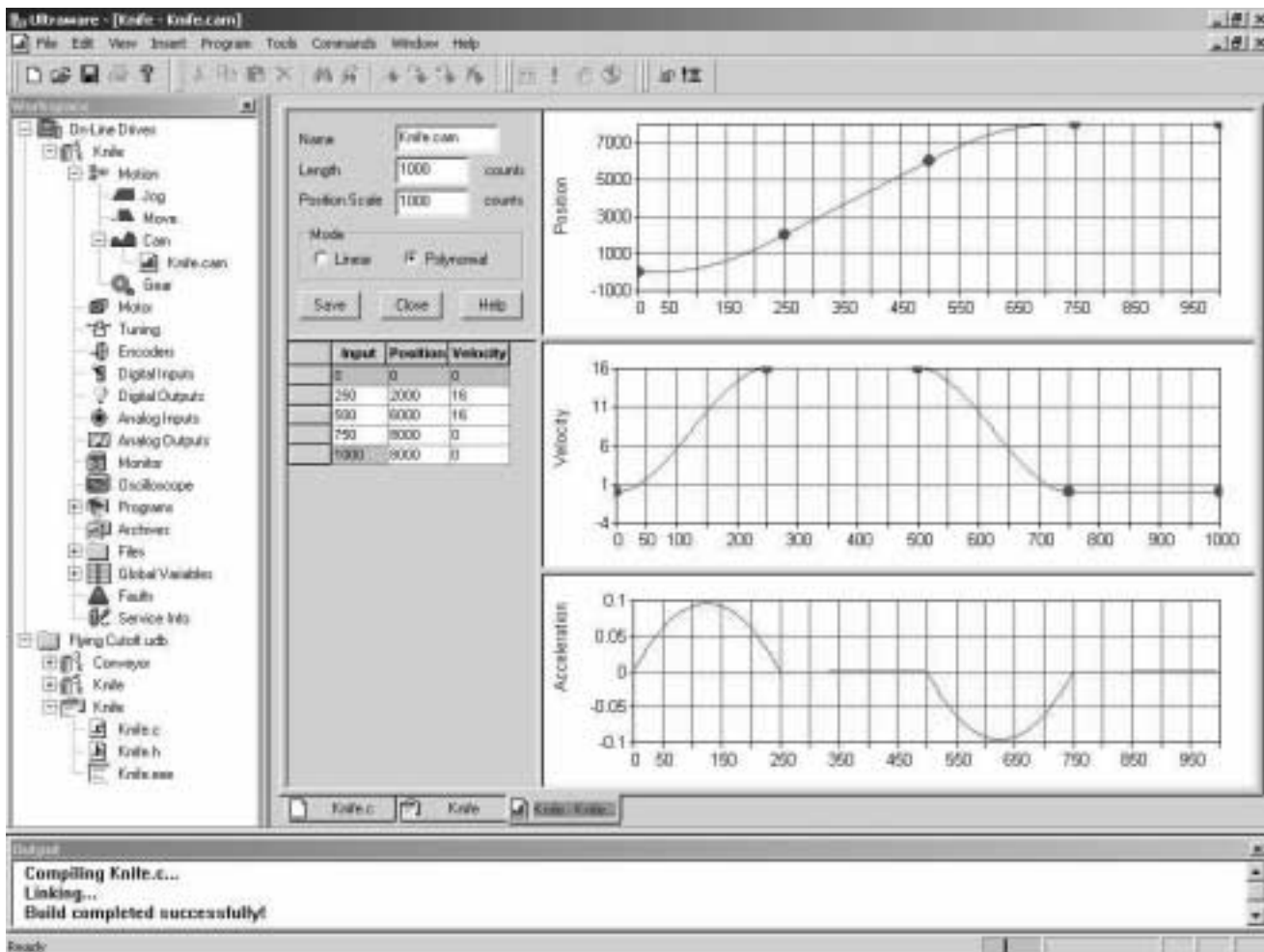


Note: There is no Ultraware interface for the commissioning of Ultra5000 IPD with the DeviceNet interface.

Developing Ultraware Cam Profiles for the Ultra5000

The Ultraware Cam Editor allows you to design, graph and save complex motion profiles to the Ultra5000 IPD. This graphical interface combines point-and-click profile building with drag-and-drop editing and adjustment. You can select either a linear interpolation or polynomial interpolation position profile. The velocity graph is populated automatically by default, and velocity adjustments can be made at the position points defined on the position graph. The graphical displays depict axis position, velocity and acceleration for preliminary motion analysis. The velocity and acceleration graphs are especially useful for profile dynamics and equipment qualification. Position and velocity information is also displayed in table form for the points defined.

Figure 5.18
Ultraware Cam Editor for Ultra5000

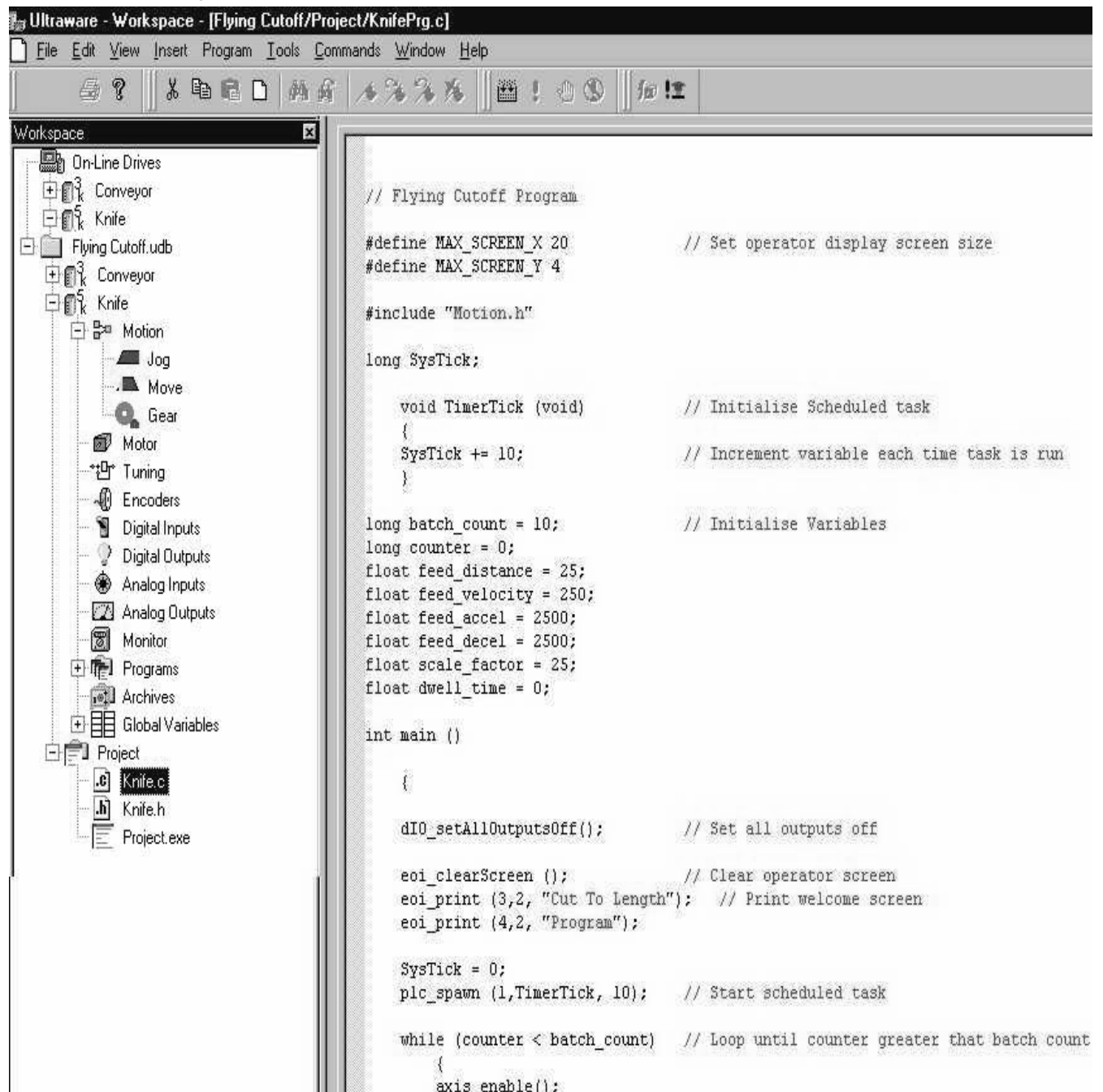


Programming the Ultra5000 with Ultraware

Ultraware includes a full-featured color-syntax editor and compiler for developing Ultra5000 C motion programs. To program a specific drive, drag and drop the completed motion program onto the drive. The executable program is stored in the Ultra5000 flash memory. The source code for the program may also be stored in the flash memory, but it is typically stored off-line.

C motion programs and compiled executable programs are stored in the Ultraware file as shown below.

Figure 5.19
Ultraware Motion Program Editor



Programming an Ultra5000 Intelligent Positioning Drive

You can create Ultra5000 motion programs by using motion commands within an ANSI C format. The Ultra5000 is the first intelligent positioning drive to leverage the power and flexibility of the standard ANSI C language. Furthermore, ANSI C programming language features:

- An excellent capability to handle arrays, strings, numeric conversions, and math operations.
- A rich set of iteration and selection structures such as If-Then, While, Do-While, For, and Switch operations.
- Compiled programs for fast execution speed and very compact programs.

Ultraware User Programming Specifications

Specification	Description
Language	Compiled ANSI C with Library of Motion Commands
Programming Environment	Full-Featured Color Syntax Editor and C Compiler Integrated with Ultraware Software
Operating System	Real-Time Multi-Tasking Flash Upgradeable
User Program Memory Capacity	512 Kbytes
User Program Memory Storage Medium	Flash Memory, 100,000 Write Cycles
Non-Volatile Memory Capacity	32 Kbytes (approximately 8000 non-volatile user variables)
Non-Volatile Memory Storage Medium	nvSRAM (High-Speed SRAM/EEPROM)

Ultraware Motion Library Commands

The following section contains the library of C commands used to create Ultra5000 motion programs.

Control Setting Functions

Command	Function
Axis Attributes <ul style="list-style-type: none"> • AxisGetCommandCur • AxisGetCommandPos • AxisGetCommandVel • AxisGetFeedbackOffset • AxisGetFeedbackPos • AxisGetFeedbackVel • AxisGetKff • AxisGetKp • AxisGetFGain • AxisGetIGain • AxisGetLowerCurLimit • AxisGetPGain 	<ul style="list-style-type: none"> • AxisGetPosError • AxisGetUpperCurLimit • AxisGetVelError • AxisSetFeedbackOffset • AxisSetFGain • AxisSetIGain • AxisSetKff • AxisSetKp • AxisSetLowerCurLimit • AxisSetPGain • AxisSetUpperCurLimit Get and set axis attributes, plus any axis offset.

Command	Function
Axis Services <ul style="list-style-type: none"> • AxisDisable • AxisIsEnabled 	Turn feedback on or off and determine if the axis is enabled.
Axis Status <ul style="list-style-type: none"> • AxisIsEnabled 	Query axis status.
Control Services <ul style="list-style-type: none"> • ControlClearFault 	Manage control services.
Control Attributes <ul style="list-style-type: none"> • ControlGetFault • EncoderGetOutput 	Get control attributes.
Program Services <ul style="list-style-type: none"> • InitMotionLibrary • Sleep 	Manage program execution.

Motion Functions

Command	Function
Gear Attributes <ul style="list-style-type: none"> • GearGetVel • GearSetRatio 	Get and set gear attributes.
Gear Services <ul style="list-style-type: none"> • GearDisable • GearEnable 	Electronically gear the slave (servo) axis to the master (auxiliary) axis at a pre-set ratio.
Gear Status <ul style="list-style-type: none"> • GearIsEnabled 	Activate gear.
Jog Attributes <ul style="list-style-type: none"> • JogSetAcc • JogSetDec • JogSetVel 	Get and set jog attributes.
Jog Services <ul style="list-style-type: none"> • JogAbort • JogForward • JogReverse • JogStop 	Jog the axis in a specified direction, at a specified velocity, using acceleration and deceleration values.
Jog Status <ul style="list-style-type: none"> • JogAtSpeed • JogGetMode • JogGetState • JogInProgress 	Query jog status.

Command	Function
Move Attributes <ul style="list-style-type: none"> • MoveSetAcc • MoveSetDec • MoveSetPos • MoveSetVel 	Get and set move attributes.
Move Services <ul style="list-style-type: none"> • MoveAbort • MoveCorrect • MoveCorrectAbs • MoveCorrectInc • MoveDistance • MovePosition • MoveStop 	Move the axis to a specified absolute position, or by a specified incremental distance.
Move Status <ul style="list-style-type: none"> • MoveAtSpeed • MoveInProgress 	Query move status.

Digital and Analog I/O Functions

Command	Function
Analog Input Attributes <ul style="list-style-type: none"> • AnalogInputGetVoltage 	Read voltage from a specified analog input channel.
Analog Output Attributes <ul style="list-style-type: none"> • AnalogOutputSetVoltage 	Set the state of a specified analog output.
Digital Inputs <ul style="list-style-type: none"> • InputGetState 	Return the state of the specified digital input.
Digital Output Attributes <ul style="list-style-type: none"> • OutputGetState • OutputSetState 	Determine the state of a specified digital output.
Digital Output Services <ul style="list-style-type: none"> • OutputSetAllOff • OutputSetAllOn 	Set the state of all digital outputs.

Latch Functions

Command	Function
Latch Attributes <ul style="list-style-type: none">LatchGetOutputLatchGetAutoModeLatchGetCount	Get latch attributes.
Latch Services <ul style="list-style-type: none">LatchOnIndexLatchOnInputLatchResetLatchSetAutoMode	Arm a registration event that stores the motor encoder position or auxiliary encoder position on the specified edge of a digital input or encoder index.
Latch Status <ul style="list-style-type: none">LatchTriggered	Query latch status.

Non-Volatile Array Functions

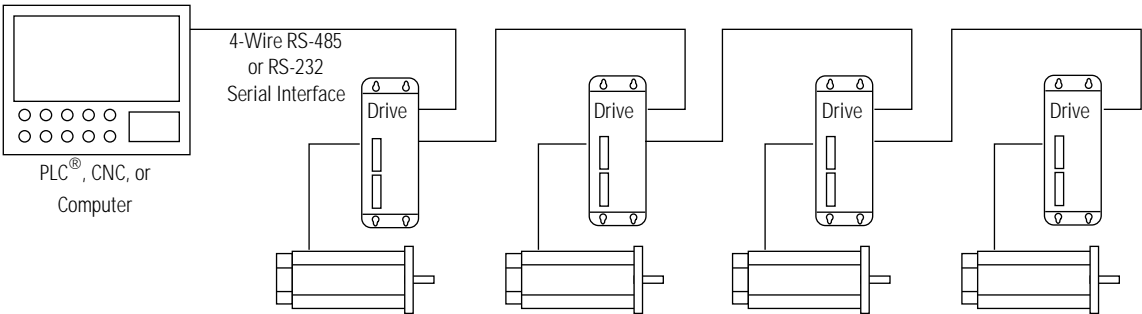
Command	Function
Non-Volatile Array Attributes <ul style="list-style-type: none">FloatArrayGetElementFloatArraySetElementLongArrayGetElementLongArraySetElement	Store and retrieve non-volatile array functions.
Non-Volatile Array Services <ul style="list-style-type: none">FloatArraySelectLongArraySelect	Select array to access.

Host Communications

The following graphic illustrates how host communications provides optional drive configuration using a drive’s serial communications interface. This powerful feature allows your controller to access all of the drive’s digital parameters and functions. The protocol includes error checking to ensure the integrity of the transmitted commands.

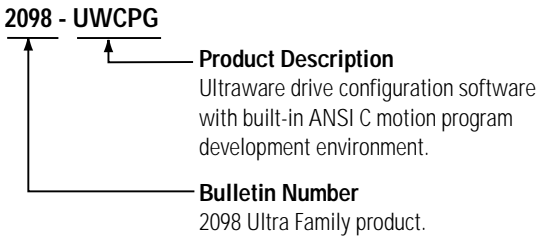
In installations that have multiple axes, a host computer can address up to 32 Ultra3000 or Ultra5000 drives. These drives communicate with the host computer using a 4-wire RS-485 or 2-wire RS-232 interface.

Figure 5.20
Host Mode



Ultraware Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your software. For questions regarding product availability, contact your Allen-Bradley distributor.



GML Commander

GML, the Graphical Motion Control Language, is used to program Allen-Bradley 1394 and IMC-S Class motion controllers. GML Commander Version 4.03, a member of the GML family, provides easy-to-use, graphical, object-oriented programming capability that reduces the time required to learn motion control programming and makes troubleshooting easier. GML Commander integrates software programming and debugging to solve your motion control problems. GML Commander allows you to program the following controllers:

- 1394 GMC (1394X-SJTXX-X-XX)
- IMC S Class Compact, Basic, or Integrated

GML Commander programming software features:

- Graphical trace, step and debug functions for verification that programs are running properly.
- On-line, context-sensitive help for assistance with icon-specific programming problems.
- A five-pane, multi-view suite of windows that you can size for convenient ability to simultaneously view programming icons, error reports, parameters you need to monitor, and a tree diagram of your program.
- Extensive use of wizards for control and axis configuration for the novice programmer who wants to program in a menu-based, sequential environment.
- Dual diagram/view trace capability for the ability to view and debug programs in the normal (icon-based) or the terminal (code-based) modes.
- Single-click diagram navigation that reduces time spent programming.

PC Requirements

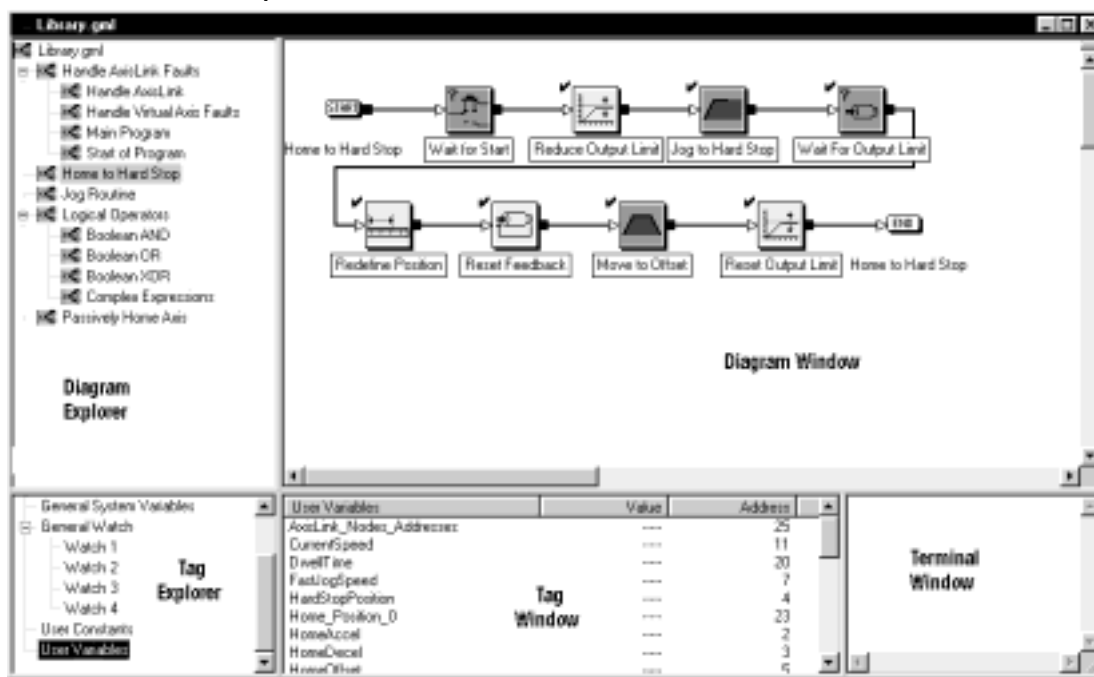
To use GML Commander programming software, your personal computer must meet the following requirements:

- Pentium-based IBM-compatible with 10 MB of hard disk space and 486 or higher microprocessor
- 8 MB of RAM (minimum), 16 MB of RAM (recommended)
- Microsoft Windows 95/WindowsNT 4.0
- Windows-compatible mouse with mouse driver
- One serial port (com1, com2, com3, or com4) to communicate with the controller
- A second serial port if using a serial mouse
- VGA monitor with standard 640 x 480 resolution (minimum), SVGA monitor with 600 x 800 resolution (recommended)
- 3.5 in. high-density diskette drive (1.44 MB) if installing GML Commander from diskettes
- CD ROM drive if installing GML Commander from CD ROM

GML Commander Workspace

GML Commander software allows you to create an application diagram by placing function blocks, representing actions, in a certain order. By placing your function blocks in a sequence, you control the order of operations within your motion control application. The GML Commander workspace provides all functions and features that you need to create, edit and test your application diagrams as shown below.

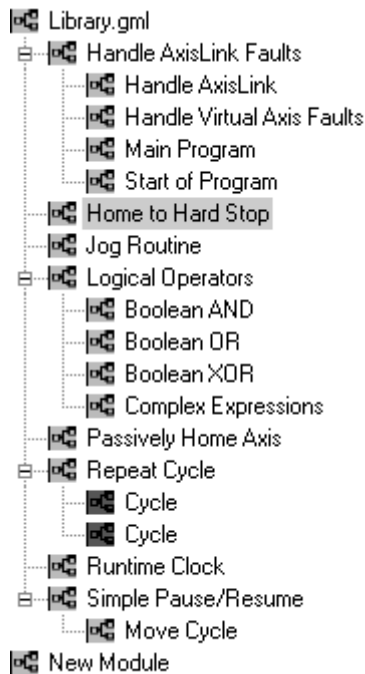
Figure 5.21
GML Commander Workspace



GML Commander Diagram Explorer

The GML Commander Diagram Explorer provides a hierarchical tree that shows the contents and organization of the application diagram as shown below.

Figure 5.22
GML Commander Diagram Explorer



The Diagram Explorer allows you to move, open and view the blocks and modules within an application diagram. More specifically, you can perform the following actions:

- Navigate or edit programs on a module level
- Explode or collapse branches

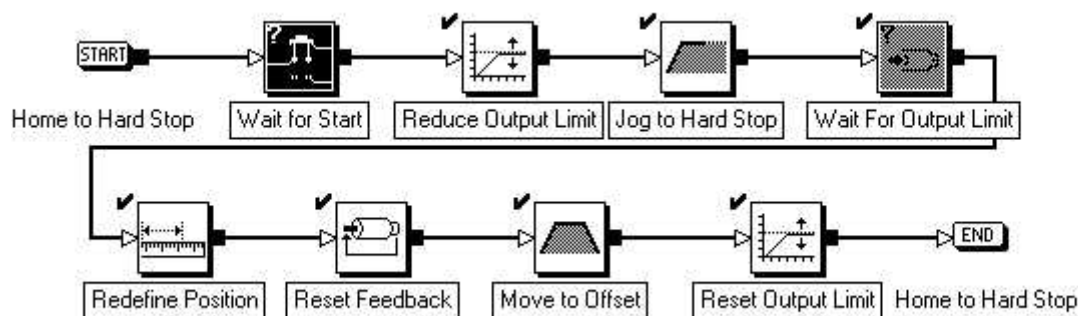
Note: The Diagram Explorer shows the contents of an application diagram.

GML Commander Diagram Window

The GML Commander Diagram Window allows you to develop and maintain your application diagram as shown below.

Figure 5.23

GML Commander Diagram Window



Note: The appearance of certain blocks and connections in the Diagram Window is determined by the module you select in the Diagram Explorer as shown in Figure 5.26.

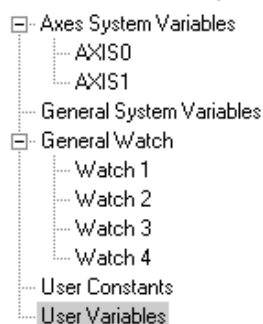
Note: Each diagram has a start and end block at the root level in between which is one or more functional blocks.

GML Commander Tag Explorer

The GML Commander Tag Explorer allows you to navigate a hierarchy of axis tag information as shown below.

Figure 5.24

GML Commander Tag Explorer



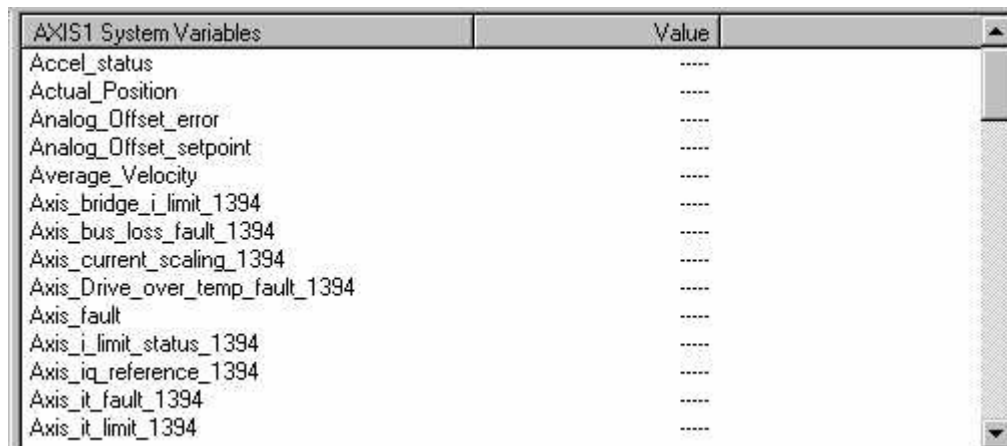
These axis tag categories contain the user variables that control the performance of each axis of motion.

GML Commander Tag Window

The GML Commander Tag Window allows you to view, edit and create axis tags as shown below.

Figure 5.25

GML Commander Tag Window



AXIS1 System Variables	Value
Accel_status	-----
Actual_Position	-----
Analog_Offset_error	-----
Analog_Offset_setpoint	-----
Average_Velocity	-----
Axis_bridge_i_limit_1394	-----
Axis_bus_loss_fault_1394	-----
Axis_current_scaling_1394	-----
Axis_Drive_over_temp_fault_1394	-----
Axis_fault	-----
Axis_i_limit_status_1394	-----
Axis_iq_reference_1394	-----
Axis_it_fault_1394	-----
Axis_it_limit_1394	-----

Note: You can view, edit and create axis tags while either online or offline.

GML Commander Terminal Window

When you are online, the GML Commander Terminal Window allows you to view the command/response links for your motion controller as shown below.

Figure 5.26

GML Commander Terminal Window

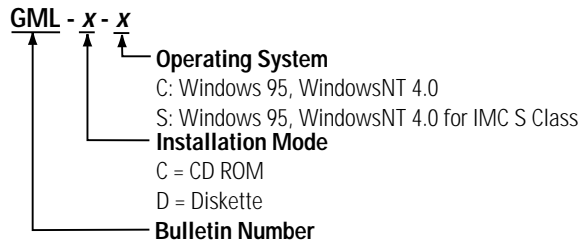


```
Installed Firmware: 303103.2
Program Not Running - "Application ID"
Program in Control Does Not Match Current Dis
Control Memory Unlocked - Command Mode E
```

Note: GML Commander allows you to view, within the Terminal Window, motion controller command/response links in either the controller's native language or an independent language.

GML Commander Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your software. For questions regarding product availability, contact your Allen-Bradley distributor.



Motors

Brushless Servo Motors

You may choose from among seven families of brushless servo motors. F-, H-, MP-230 volt, N-, and Y-Series motors are used with the 2098 motion control system, and MP-460 volt, 1326AB, and 1326AS motors with the 1394 motion control system. A wide range of characteristics and attributes allows you to select a motor that meets all the requirements of your motion control application.

Determining Which Motor to Use

Use the following table to help determine which family of motors you need:

Motor	Description	Typical Applications	Characteristics
F-Series	<ul style="list-style-type: none"> • Medium-inertia brushless servo motors • Continuous torque - 3.5 to 23.7 N-m (31 to 210 lb-in.) • Speeds up to 3600 RPM • 2000-line incremental encoder standard • Available with 230V windings 	<ul style="list-style-type: none"> • Web processing • Machine tool • Textile machinery • CAM replacement 	<ul style="list-style-type: none"> • Higher inertia-matching capability • Heavy duty continuous operations • Environmentally rugged
H-Series	<ul style="list-style-type: none"> • Low-inertia brushless servo motors • Continuous torque - 0.5 to 50 N-m (5 to 450 lb-in.) • Speeds up to 6000 RPM • 2000-line incremental encoder standard • Available with 230V windings 	<ul style="list-style-type: none"> • Smart conveyors • Packaging machinery • Material feeding • Pick-and-place machines • High duty cycle applications 	<ul style="list-style-type: none"> • High acceleration and peak torques • High-speed point-to-point positioning • Environmentally rugged
MP-Series	<ul style="list-style-type: none"> • Low-inertia brushless servo motors • Continuous torque - 2 to 10.20 N-m (17.70 to 90 lb-in.) • Speeds up to 5000 RPM • Multiple feedback options including absolute multi-turn high resolution, absolute single-turn high resolution, and 2000 line incremental encoder • Available with 230V and 460 windings. • Key or no key option 	<ul style="list-style-type: none"> • Packaging • Food processing • Electronics • Automotive • Converting • Metal forming • Derivative for semiconductor 	<ul style="list-style-type: none"> • High torques • Reduced size • Environmentally rugged • High torque-to-inertia ratio
N-Series	<ul style="list-style-type: none"> • Medium inertia, NEMA-style brushless servo motors • Continuous torque - 0.18 to 5.9 N-m (1.6 to 5.2 lb-in.) • Speeds up to 6000 RPM • 1000-, 2000-line incremental encoder standard • Available with 230V windings 	<ul style="list-style-type: none"> • Web processing • Machine tool • Textile machinery • CAM replacements • Stepper replacement 	<ul style="list-style-type: none"> • High-performance stepper replacement • Excellent mechanical interface • Environmentally rugged

Determining Which Motor to Use, Continued

Motor	Description	Typical Applications	Characteristics
Y-Series	<ul style="list-style-type: none"> • Small, low-inertia brushless servo motors • Continuous torque - 0.17 to 2.5 N-m (1.5 to 22 lb-in.) • Speeds up to 4500 RPM • Available with either 115V or 230V windings 	<ul style="list-style-type: none"> • Robotics • Material handling • X-Y tables • Specialty machinery • Semiconductor manufacturing • Medical/laboratory equipment • Light packaging machines • Office machinery 	<ul style="list-style-type: none"> • Fast accelerations • Low-inertia precision • Application flexibility
1326AB	<ul style="list-style-type: none"> • High-performance, medium inertia brushless servo motors with specially engineered housing for reduced length • Special flux profile permanent magnets for increased servo response • Continuous Torque - 2.7 to 50.8 N-m (24 to 450 lb-in.) • Speeds up to 7250 RPM • Available with 460V windings 	<ul style="list-style-type: none"> • Machine tool • Bottle filling • Press feed • Progressive die manufacturing 	<ul style="list-style-type: none"> • Excellent servo response • High torque • Application Flexibility • Higher inertia matching capability • Environmentally rugged
1326AS	<ul style="list-style-type: none"> • High-performance, low inertia rare earth servo motors • Economical, compact design • Continuous Torque - 0.7 to 49.3 N-m (6.1 to 436 lb-in.) • Speeds up to 6500 RPM • Available with 460V windings 	<ul style="list-style-type: none"> • Rotary knife systems • Vertical form, fill and seal • Progressive die manufacturing 	<ul style="list-style-type: none"> • Environmentally rugged • High torque • Application Flexibility • Low inertia for faster acceleration

F-Series Motors



F-Series motors are commonly used when applications require higher inertia-matching capability. Typical applications include web and film processing, machine tool/metal cutting, textile machinery, or cam replacements.

Each servo motor features:

- Compact design that is mechanically interchangeable with the H-Series family.
- Continuous torque from 3.5 to 28 N-m (31 to 245 lb-in.).
- Speeds up to 4000 RPM.
- Ferrite permanent magnet rotors that provide approximately four times greater rotor inertia than the H-Series family for matching larger load inertias.
- Internal thermal switch to indicate overheating.
- Motor-mounted 2000-line optical encoder featuring quadrature output of 8000 pulses per revolution.
- Water-tight MS connections compatible with standard cable assemblies, and extruded aluminum housing that provide an IP65 rating when the optional shaft seal is installed.
- Economical, compact design ready for harsh environments.
- Optional spring-set holding brakes available with 24V DC.
- Axially-trapped front bearing in a steel insert for long life at high speeds.
- UL listed.

Note: For drive compatibility, refer to the Motor Selection Chart in *Preface*.

General Specifications

The following section contains the F-Series performance, mechanical, winding, storage/operating, and thermostat specifications.

Ultra5000 and Ultra3000 Performance Specifications for F-Series Motors^{1, 2}

Motor	Drives		Maximum speed rpm	Continuous stall torque ^{3, 4} N-m (lb-in.)	Peak torque ⁵ N-m (lb-in.)
	2098-IPD- ⁶	2098-DSD- ⁷			
F-4030	020	020 ⁶	3600	3.5 (31)	11.3 (100)
F-4050	020	020 ⁶	3500	5.2 (46)	13.6 (120)
F-4075	—	075 ⁶	3000	9.3 (82)	19.2 (170)
F-6100	—	075 ⁶	3000	13 (115)	31.1 (275)
F-6200	—	075/150 ⁶	3000	19.8 (175)	39.5 (350)
F-6300	—	075/150 ⁶	3000	23.7 (210)	49.7/56.5 (440/500)

¹ Ambient temperature is 0° C to 40° C (32° F to 104° F) for motors and 0° C to 50° C (32° F to 122° F) for drives.

² With 230V AC line voltage input.

³ At 125° C (257° F) winding temperature, in a 40° C (104° F) ambient, with motor mounted on 0.5 in. x 12 in. x 12 in. aluminum heat sink.

⁴ Brake motor continuous stall torque derated by 15%.

⁵ System limit.

⁶ These specifications also apply to Ultra5000 drives equipped with the DeviceNet option.

⁷ These specifications also apply to Ultra3000 drives equipped with the indexing, SERCOS, DeviceNet, or indexing DeviceNet options.

Mechanical Specifications

Motor	Rotor moment of inertia kg-m ² (lb-in.-s ²)	Rotor moment of inertia (brake motors) kg-m ² (lb-in.-s ²)	Motor shipping weight kg (lb)	Motor net weight kg (lb)	Brake motor shipping weight kg (lb)	Brake motor net weight kg (lb)	Damping N-m/kRPM (lb-in./kRPM)	Friction torque N-m (lb-in.)
F-4030	0.0010 (0.009)	0.0011 (0.010)	11.0 (23.0)	9.0 (19.6)	12.5 (27.6)	10.9 (24.0)	0.06 (0.5)	0.063 (0.56)
F-4050	0.0021 (0.019)	0.0022 (0.020)	15.8 (34.8)	14.1 (31.0)	17.8 (39.2)	16.0 (35.2)	0.10 (0.94)	0.11 (0.94)
F-4075	0.0032 (0.029)	0.0033 (0.030)	21.5 (47.2)	14.1 (42.0)	23.9 (52.6)	21.2 (46.8)	0.15 (1.3)	0.17 (1.5)
F-6100	0.064 (0.057)	0.007 (0.061)	25.2 (55.4)	22.3 (49.2)	30 (66)	27.1 (59.8)	0.16 (1.4)	0.17 (1.5)
F-6200	0.0107 (0.095)	0.011 (0.098)	33.5 (73.8)	30.9 (68.2)	38.4 (84.4)	35.6 (78.4)	0.24 (2.1)	0.24 (2.1)
F-6300	0.0162 (0.144)	0.017 (0.147)	46 (101.2)	43.2 (95.2)	51.4 (113.1)	48 (105.8)	0.37 (3.3)	0.46 (4.1)

Winding Specifications

Motor	Sine wave K _T torque constant at 25° C (77° F) ¹ N-m/A (lb-in./A)	K _E voltage constant ² V/kRPM	Winding resistance phase to phase at 25° C (77° F) Ohm	Winding inductance phase to phase mH	Thermal resistance ³ °C/Watt	Poles
F-4030	0.54 (4.8)	66	2.2	6.8	0.63	8
F-4050	0.54 (4.8)	66	0.89	3.3	0.48	
F-4075	0.73 (6.5)	89	0.98	3.4	0.4	
F-6100	0.71 (6.3)	86	0.51	3.3	0.45	
F-6200	0.7 (6.2)	85	0.26	1.7	0.37	
F-6300	0.73 (6.5)	89	0.16	1.1	0.3	

¹ Peak value of per phase sine wave amps.

² Peak value of sinusoidal phase to phase volts.

³ At 125° C (257° F) winding temperature, in a 40° C (104° F) ambient, with motor mounted on 0.5 in. x 12 in. x 12 in. aluminum heat sink.

Storage and Operating Specifications

Specification	Description
Ambient Temperature	Operating: 0° to 40° C (32° to 104° F) Storage: -30° to 70° C (-25° to 158° F)
Relative Humidity	5% to 95% non-condensing
Shock	10g peak, 6 ms duration
Vibration	2.5g peak, 3-2000Hz

Thermostat Specifications

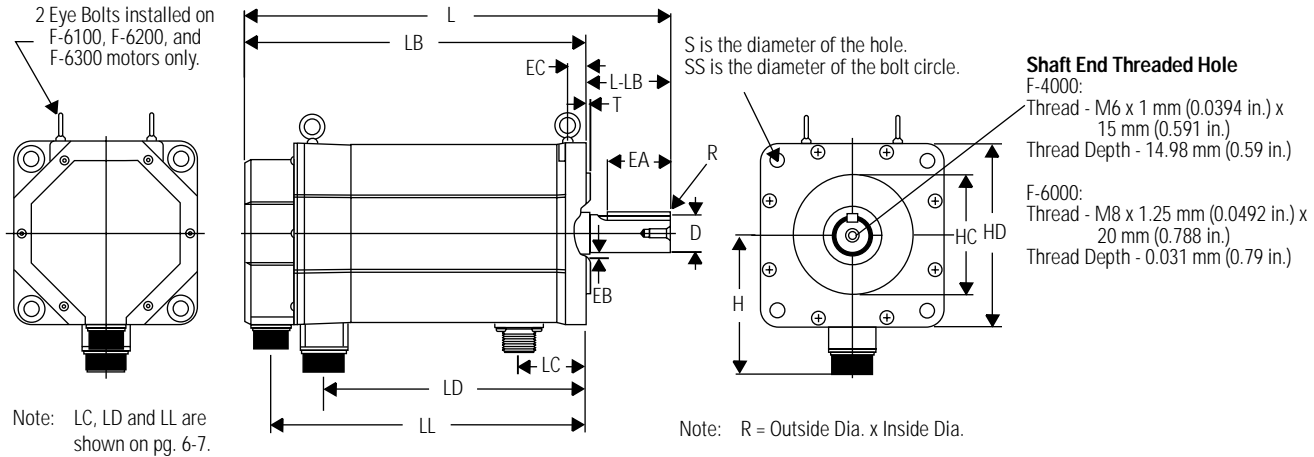
Specification	Description
Rated voltage	0 - 250V DC or 50/60 Hz AC ¹
Rated current	2.5A at power factor of 1.0; 1.6A at power factor of 0.6
Maximum switching current	5A
Contact resistance	Less than 0.10 Ohms maximum
Contacts	Normally closed
Insulation dielectric	Mylar Nomex capable of withstanding 1500V AC RMS 50/60 Hz for 1 minute
Opening temperature $\pm 5^{\circ}$ C ($\pm 41^{\circ}$ F)	140° C (284° F)

¹ The thermostat is normally used as a switch for a 24V DC logic signal.

Motor Dimensions

The following section contains the dimensions for F-Series motors.

Figure 6.1
F-Series Servo Motor Dimensions (F-xxxx-Q-xxxAx)



Motor	D mm (in.)	EA mm (in.)	EB mm (in.)	EC mm (in.)	H mm (in.)	HC mm (in.)	HD mm (in.)	L mm (in.)	L with brake mm (in.)	LB mm (in.)	L-LB mm (in.)	R mm x mm (in. x in.)	S mm (in.)	SS mm (in.)	T mm (in.)
F-4030	19 (0.75) ⁶	38 (1.49)	22.2 (0.875) ⁵	16 (0.64)	102 (4.02)	110 (4.33) ²	127 (5.00)	244 (9.61)	257 (10.12)	194 (7.64)	50 (1.97) ¹	6 x 6 (0.24 x 0.24)	10 (0.39) ⁴	145 (5.71)	3 (0.12) ³
F-4050	19 (0.75) ⁶	38 (1.49)	22.2 (0.875) ⁵	16 (0.64)	102 (4.02)	110 (4.33) ²	127 (5.00)	322 (12.68)	335 (13.19)	272 (10.71)	50 (1.97) ¹	6 x 6 (0.24 x 0.24)	10 (0.39) ⁴	145 (5.71)	3 (0.12) ³
F-4075	19 (0.75) ⁶	38 (1.49)	22.2 (0.875) ⁵	16 (0.64)	102 (4.02)	110 (4.33) ²	127 (5.00)	400 (15.76)	413 (16.26)	350 (13.78)	50 (1.97) ¹	6 x 6 (0.24 x 0.24)	10 (0.39) ⁴	145 (5.71)	3 (0.12) ³
F-6100	35 (1.38) ⁶	60 (2.36)	36.5 (1.438) ⁵	19 (0.75)	131 (5.16)	114.3 (4.50) ²	173 (6.81)	335 (13.19)	326 (12.83)	255 (10.04)	80 (3.15) ¹	10 x 8 (0.39 x 0.32)	13 (0.53) ⁴	200 (7.87)	4 (0.16) ³
F-6200	35 (1.38) ⁶	60 (2.36)	36.5 (1.438) ⁵	19 (0.75)	131 (5.16)	114.3 (4.50) ²	173 (6.81)	400 (15.76)	390 (15.35)	320 (12.60)	80 (3.15) ¹	10 x 8 (0.39 x 0.32)	13 (0.53) ⁴	200 (7.87)	4 (0.16) ³
F-6300	35 (1.38) ⁶	60 (2.36)	36.5 (1.438) ⁵	19 (0.75)	131 (5.16)	114.3 (4.50) ²	173 (6.81)	500 (19.7)	490 (19.29)	420 (16.53)	80 (3.15) ¹	10 x 8 (0.39 x 0.32)	13 (0.53) ⁴	200 (7.87)	4 (0.16) ³

¹ ±0.5 mm (0.197 in.)

² -0.035 mm (-0.001379 in.)

³ -0.013 mm (-0.0005122 in.)

⁴ +0.016 mm (+0.0006304 in.), -0.035 mm (-0.001379 in.)

⁵ +0.10 mm (+0.00394 in.), -0.05 mm (0.00197 in.)

⁶ -0.013 mm (-0.0005122 in.)

Supplemental Motor Dimensions

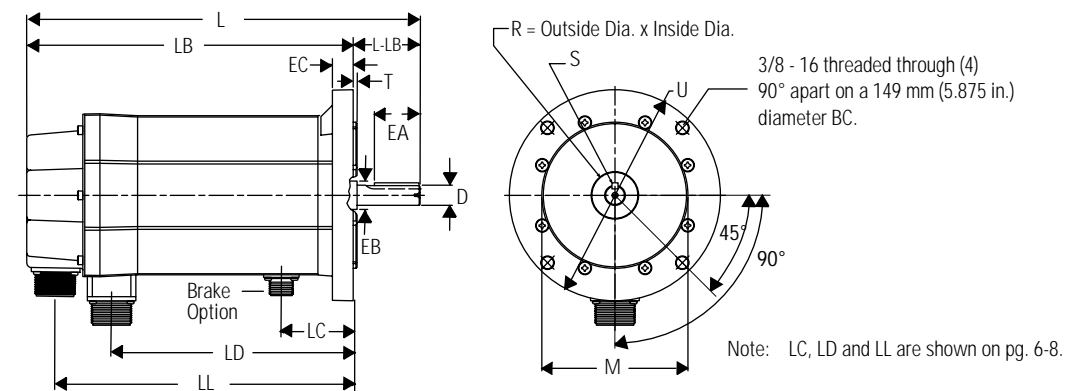
Motor	LC - Brake Connector mm (in.)	LD - Encoder Connector mm (in.)	LL - Power Connector mm (in.)
F-4030 Brake	— 56 (2.2)	126 (4.96) 189 (7.44)	172 (6.77) 235 (9.25)
F-4050 Brake	— 56 (2.2)	204 (8.03) 267 (10.51)	250 (9.84) 313 (12.32)
F-4075 Brake	— 56 (2.2)	282 (11.1) 345 (13.58)	228 (8.98) 301 (11.85)
F-6100 Brake	— 59 (2.32)	183 (7.2) 254 (10)	233 (9.17) 304 (11.97)
F-6200 Brake	— 59 (2.32)	248 (9.76) 318 (12.52)	298 (11.73) 368 (14.49)
F-6300 Brake	— 59 (2.32)	348 (13.7) 418 (16.46)	398 (15.67) 468 (18.42)

F-4000 NEMA 56C Dimensions

The following section contains the F-4000 NEMA 56C dimensions.

Figure 6.2

F-4000 Servo Motor Dimensions (F-40xx-Q-x0xAx)



Motor	D mm (in.)	EA mm (in.)	EB mm (in.)	EC mm (in.)	L mm (in.)	L (with brake) mm (in.)	LB mm (in.)	L-LB mm (in.)	M mm (in.)	R mm (in.)	S mm (in.)	T mm (in.)	U mm (in.)
F-4030 NEMA 56C	15.9 (0.625) ⁶	36 (1.41) full depth	22 (0.875)	16.3 (0.64)	246 (9.69)	257 (10.12)	194 (7.64)	52 (2.06) ¹	114.3 (4.5) ²	36.5 (1.437) x 22.2 (0.875) ⁴	4.8 (0.1875) width and depth x 35 (1.375) length ⁵	3 (0.12) ³	165 (6.5)
F-4050 NEMA 56C					324 (12.76)	335 (13.19)	272 (10.71)						
F-4075 NEMA 56C					402 (15.83)	413 (16.26)	350 (13.78)						

¹ Tolerance is ± 0.508 mm (± 0.02 in.)

² Tolerance is -0.0762 mm (-0.003 in.)

³ Tolerance is ± 0.254 mm (± 0.01 in.)

⁴ 6.3 mm (0.25 in.) shaft seal (optional, not included).

⁵ Key is supplied.

⁶ Tolerance is -0.127 mm (-0.005 in.)

Supplemental NEMA Motor Dimensions

Motor	LC - Brake Connector mm (in.)	LD - Encoder Connector mm (in.)	LL - Power Connector mm (in.)
F-4030 Brake	— 2.21 (5.6)	4.97 (12.6) 7.45 (18.9)	6.77 (17.2) 9.25 (23.5)
F-4050 Brake	— 2.21 (5.6)	8.04 (20.4) 10.52 (26.7)	9.84 (25.0) 12.32 (31.3)
F-4075 Brake	— 2.21 (5.6)	11.12 (28.2) 13.59 (34.5)	12.92 (32.8) 15.39 (39.1)

Load Force Ratings

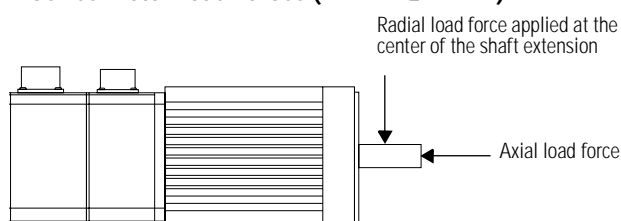
The following section contains the F-Series motor radial and axial load force ratings.

Motor	500 RPM kg (lbs)	1000 RPM kg (lbs)	2000 RPM kg (lbs)	3000 RPM kg (lbs)	4000 RPM kg (lbs)
F-4030	34.5 (76)	27.2 (60)	21.3 (47)	18.6 (41)	17.2 (38)
F-4050	39.9 (88)	31.3 (69)	24.9 (55)	21.8 (48)	20.0 (44)
F-4075	41.7 (92)	33.1 (73)	26.3 (58)	23.1 (51)	20.9 (46)
F-6100	72.1 (159)	57.1 (126)	45.4 (100)	39.5 (87)	—
F-6200	78 (172)	61.7 (136)	49 (108)	42.6 (94)	—
F-6300	83 (183)	65.8 (145)	52.2 (115)	45.8 (101)	—

Motors are capable of carrying an axial load in most applications according to the following general guidelines. These guidelines should only be used as approximations.

Figure 6.3

F-Series Motor Load Forces (F-xxxx-Q-xxxAx)



- With no radial load, the axial load rating is 100% of the radial load rating from the table above.
- With a radial and an axial load, the axial load rating is 44% of the radial load rating from the table above.

Brake Specifications and Application Guidelines

The following section contains the F-Series brake motor specifications and application guidelines.

Specifications

Motor Series	Maximum backlash (brake engaged) minutes	Holding torque N-m (lb-in.)	Coil current at 24V DC Amps
F-4000	44	10.2 (90)	0.69
F-6000	29	31.1 (275)	1.30

Application Guidelines

The brakes offered as options on these servo motors are holding brakes designed to hold the motor shaft at 0 rpm up to the rated brake holding torque. These spring-set type brakes release when voltage is applied to the brake coil.

The brakes are *not* designed for stopping rotation of the motor shaft. Servo drive inputs should be used to stop motor shaft rotation. The recommended method of stopping motor shaft rotation is to command the servo drive to decelerate the motor to 0 rpm, and engage the brake after the servo drive has decelerated the motor to 0 rpm.

If system main power fails, the brakes can withstand use as stopping brakes. However, use of the brakes as stopping brakes creates rotational mechanical backlash that is potentially damaging to the system, increases brake pad wear and reduces brake life. The brakes are *not* designed nor are they intended to be used as a safety device.

A separate power source is required to disengage the brake. This power source can be controlled by the servo motor controls, in addition to manual operator controls.

Encoder Data

The following section contains the F-Series encoder specifications.

Encoder Specifications

Specification	Description
Line Count	2000 lines/revolution ¹
Supply Voltage	5V DC
Supply Current	250 mA maximum
Line Driver	26LS31
Line Driver Output	TTL
Index Pulse	F-4000 and F-6000 Series when shaft keyway faces the connectors (0°±10)

¹Standard line count before quadrature.

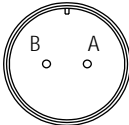
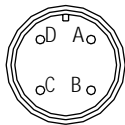
Note: Encoders are factory aligned. Do not adjust them outside the factory.

Connector Data

The following section contains the power, brake, and encoder connector pins and signals.

Power Connector and Optional Motor Brake Connector

Power Connector (All F-Series Motors)		Brake Connector (F-Series Motors with an 04 Designator)	
Pin	Signal	Pin	Signal
A	U	A	BR+
B	V	B	BR-
C	W		
D	Motor Case		



Encoder Connector (F-4000 and F-6000 Motors)

Pin	Signal	Pin	Signal
A	A+	K	+5V DC
B	A-	L	COM
C	B+	M	COM
D	B-	N	Hall B
E	I+	P	Hall C
F	I-	R	TS+
G	Encoder Case	S	TS-
H	ABS	T	Hall A
J	+5V DC		



Wire Sizing Recommendations

The following section contains the wire sizing recommendations for the power, encoder and brake connectors.

Connectors

Motor	Power Connector	Motor	Encoder Connector	Motor	Brake Connector
	Wire ¹ mm ² (AWG)		Wire mm ² (AWG)		Wire mm ² (AWG)
F-4030	1.5 ² (16)	F-4030	0.25 ² (24) 0.324 ² (22)	F-4030	0.75 ² (18)
F-4050	2.5 ² (14)	F-4050		F-4050	
F-4075		F-4075		F-4075	
F-6100	4 ² (12)	F-6100		F-6100	
F-6200	10 ² (8)	F-6200		F-6200	
F-6300		F-6300		F-6300	

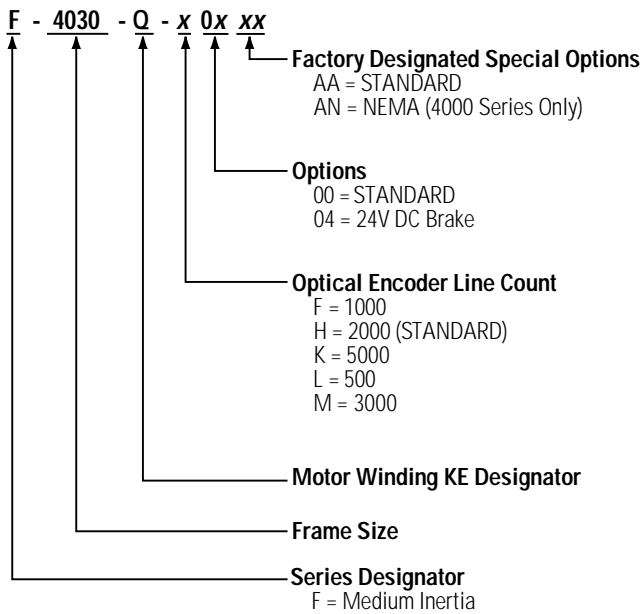
¹ Sizes are recommended minimum values for 4 conductors (U, V, W and GND).

Note: Wiring should be twisted, and local regulations should always be observed.

Note: These specifications are the recommended minimum mechanical size.

F-Series Motor Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your motor. For questions regarding product availability, contact your Allen-Bradley distributor.



Note: Optional configurations or encoder line counts have extended lead times and additional charges.

Note: Options are not available in all sizes.

* The maximum speed with the 5000-line encoder is 2400 RPM because of the frequency output limit of the encoder.

H-Series Motors



H-Series motors are used when an application requires low inertia, high acceleration and peak torque. Typical applications include smart conveyors, packaging machinery, punch press/material feeding, robotic pick and place, and high duty cycle.

Each servo motor features:

- Compact design that is mechanically interchangeable with the F-4000 and F-6000 Series motors.
- Five frame sizes in twelve models.
- Continuous torque from 0.5 to 50 N-m (5 to 450 lb-in.).
- Speeds up to 6000 RPM.
- Neodymium-iron-boron permanent magnet rotors that provide low inertias for high accelerations.
- Internal thermal switch to indicate overheating.
- Motor-mounted optical encoder featuring 2000 quadrature pulses, index pulse, and standard commutation channels for trapezoidal drives.
- Water-tight MS connections compatible with standard cable assemblies, and extruded aluminum housing and environmental connectors that provide an IP65 rating when the shaft seal is installed.
- Economical, compact design ready for harsh environments.
- Optional spring-set holding brakes available with 24V DC.
- Axially-trapped front bearing in a steel insert for long life at high speeds.
- UL listed.

Note: For drive compatibility, refer to the Motor Selection Chart in *Preface*.

General Specifications

The following section contains the performance, mechanical, winding, storage/operating, and thermostat specifications.

Ultra5000 and Ultra3000 Performance Specifications for H-Series Motors^{1, 2}

Motor	Drives		Maximum speed rpm	Continuous stall torque ⁵ N-m (lb-in.)	Peak torque ⁶ N-m (lb-in.)
	2098-IPD- ³	2098-DSD- ⁴			
H-2005	010	010	6000	0.57 (5)	1.6 (14)
H-3007	010	010	5000	0.79 (7)	2.48 (22)
H-3016	020	020	5000	2.26 (20)	4.97 (44)
H-4030-P	020	020	4000	3.39 (30)	8.25 (73)
H-4050	—	030/075	4000	6.8 (60)	13.6/21.5 (120/190)
H-4075	—	030/075	3000	9.9 (88)	20.3/30.5 (180/270)
H-6100	—	075	3000	12.4 (110)	32.8 (290)
H-6200	—	075	3000	21.4 (190)	40.7 (360)
H-6300	—	150	3000	36.7 (300)	79.1 (700)
H-8350	—	150	2000	39.5 (350)	67.8 (600)
H-8500	—	150	2000	50.8 (450)	108 (960)

¹ Ambient temperature is 0° C to 40° C (32° F to 104° F) for motors and 0° C to 50° C (32° F to 122° F) for drives.

² With 230V AC line voltage input.

³ These specifications also apply to Ultra5000 drives equipped with the DeviceNet option.

⁴ These specifications also apply to Ultra3000 drives equipped with the indexing, SERCOS, DeviceNet, or indexing DeviceNet interface options.

⁵ At 125° C (257° F) winding temperature, in a 40° C (104° F) ambient; motors 3007, 3016 mounted 0.25 in. x 10 in. x 10 in.; motor 4030 mounted on 0.5 in. x 12 in. x 12 in.

⁶ System limit.

Mechanical Specifications

Motor	Rotor moment of inertia kg-m ² (lb-in.-s ²)	Rotor moment of inertia (brake motors) kg-m ² (lb-in.-s ²)	Motor shipping weight kg (lb)	Motor net weight kg (lb)	Brake motor shipping weight kg (lb)	Brake motor net weight kg (lb)	Damping N-m/kRPM (lb-in./kRPM)	Friction torque N-m (lb-in.)
H-2005	0.000015 (0.000013)	—	2.7 (6.0)	2.2 (4.9)	—	—	0.007 (0.06)	0.014 (0.12)
H-3007	0.000030 (0.00027)	0.000038 (0.00034)	3.2 (7.0)	2.6 (5.8)	3.8 (8.4)	3.4 (7.5)	0.010 (0.09)	0.014 (0.12)
H-3016	0.000080 (0.00072)	0.000089 (0.00079)	4.7 (10.4)	4.1 (9.0)	5.5 (12.1)	4.9 (10.8)	0.014 (0.12)	0.028 (0.25)
H-4030-P	0.00025 (0.0022)	0.00033 (0.0029)	7.3 (16.1)	6.8 (14.9)	9.4 (20.7)	8.8 (19.4)	0.034 (0.30)	0.034 (0.30)
H-4050	0.00046 (0.0041)	0.00054 (0.0048)	10.9 (24)	9.7 (21.4)	12.7 (28)	11.8 (26)	0.045 (0.4)	0.068 (0.60)
H-4075	0.00068 (0.0060)	0.00076 (0.0067)	14.1 (31.1)	12.9 (28.4)	16 (35.3)	14.9 (32.8)	0.068 (0.6)	0.14 (1.2)
H-6100	0.0014 (0.012)	0.0017 (0.015)	19.2 (42.3)	18.3 (40.4)	23.8 (52.5)	22.5 (49.5)	0.1 (0.9)	0.14 (1.2)
H-6200	0.0024 (0.021)	0.0027 (0.024)	28.6 (63)	27 (59.4)	32.9 (72.5)	31.6 (69.5)	0.16 (1.4)	0.24 (2.1)
H-6300	0.0034 (0.030)	0.0037 (0.033)	37.7 (83.1)	34.8 (76.8)	42.2 (93)	39.2 (86.4)	0.19 (1.7)	0.36 (3.2)
H-8350	0.0063 (0.056)	0.0093 (0.082)	46.8 (103)	44.1 (97)	53.5 (118)	50.9 (112)	0.38 (3.4)	0.32 (2.8)
H-8500	0.0094 (0.083)	0.012 (0.109)	58.1 (128)	56.1 (123.6)	64.9 (143)	61.8 (136)	0.43 (3.8)	0.4 (3.5)

Winding Specifications

Motor	Sine wave K_T torque constant at 25° C (77° F) ¹ N-m/A (lb-in./A)	K_E voltage constant ² V/kRPM	Winding resistance phase to phase at 25° C (77° F) Ohm	Winding inductance phase to phase mH	Thermal resistance ³ °C/Watt	Poles
H-2005-K	0.13 (1.2)	16	2.6	4.1	1.5	4
H-3007-N	0.28 (2.5)	34	6.6	12	1.2	6
H-3016-N	0.28 (2.5)	34	1.3	3.4	0.89	
H-4030-P	0.5 (4.4)	60	2.0	9.0	0.79	
H-4050-P	0.5 (4.4)	60	0.69	3.3	0.57	
H-4075-R	0.74 (6.6)	90	0.9	5.4	0.48	
H-6100-Q	0.68 (6)	82	0.49	4.4	0.34	8
H-6200-Q	0.66 (5.8)	80	0.18	2.2	0.31	
H-6300-Q	0.7 (6.2)	85	0.12	1.2	0.24	
H-8350-S	0.86 (7.6)	104	0.13	2.5	2.5	
H-8500-S	0.92 (8.2)	112	0.1	2.4	0.21	

¹Peak value of per phase sine wave amps.

²Peak value of sinusoidal phase to phase volts.

³At 125° C (257° F) winding temperature, in a 40° C (104° F) ambient; motors 3007, and 3016 mounted 0.25 in. x 10 in. x 10 in.; motor 4030 mounted on 0.5 in. x 12 in. x 12 in.

Storage and Operating Specifications

Specification	Description
Ambient Temperature	Operating: 0° to 40° C (32° to 104° F) Storage: -30° to 70° C (-25° to 158° F)
Relative Humidity	5% to 95% non-condensing
Shock	10g peak, 6 ms duration
Vibration	2.5g peak, 3-2000Hz

Thermostat Specifications

Specification	Description
Rated voltage	0 - 250V DC or 50/60 Hz AC ¹
Rated current	2.5A at power factor of 1.0 1.6A at power factor of 0.6
Maximum switching current	5A
Contact resistance	Less than 0.10 Ohms maximum
Contacts	Normally closed
Insulation dielectric	Mylar Nomex capable of withstanding 1500V AC RMS 50/60 Hz for 1 minute
Opening temperature ±5° C (±41° F)	140° C (284° F)

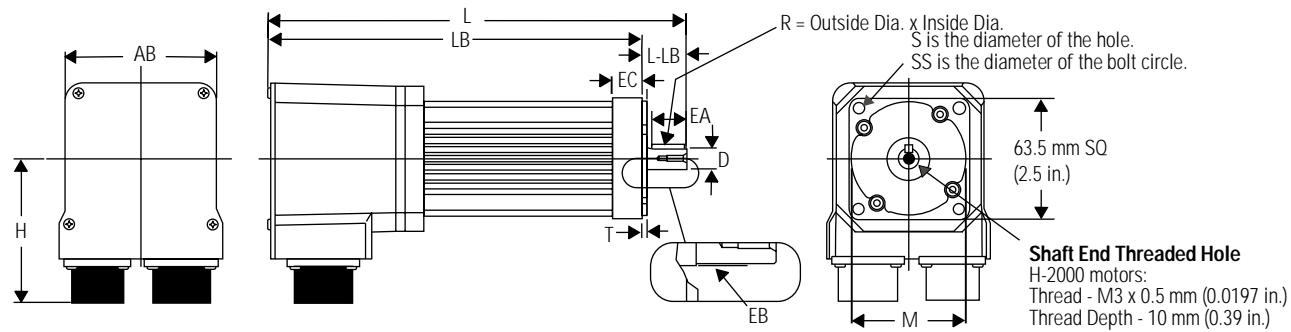
¹The thermostat is normally used as a switch for a 24V DC logic signal.

Motors Dimensions

The following section contains the dimensions for H-Series motors.

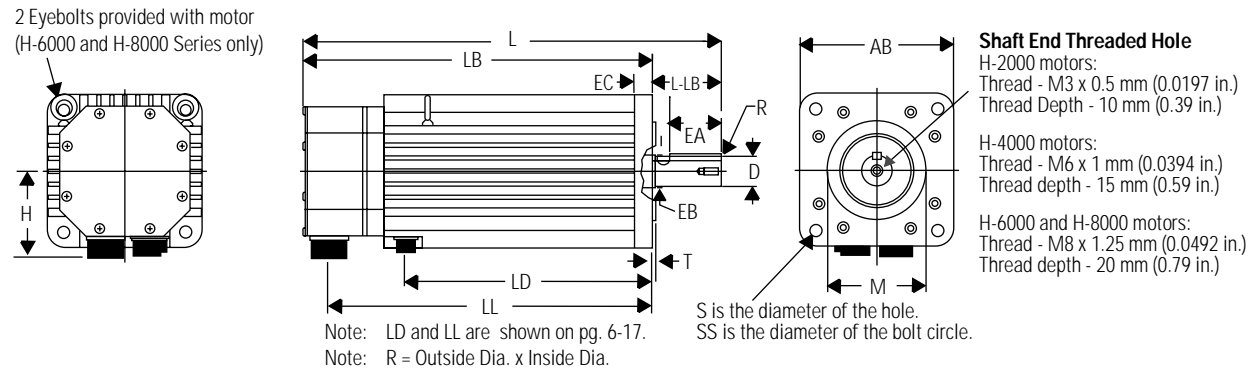
H-2000 Motors Dimensions

Figure 6.4
H-2000 Servo Motors Dimensions (H-2005-P-x0xAx)



H-3000, -4000, -6000, and -8000 Motors Dimensions

Figure 6.5
H-3000, -4000, -6000, and -8000 Servo Motors Dimensions (H-xxxx-P-x0xAx)



Motor	AB mm (in.)	D mm (in.)	EA mm (in.)	EB mm (in.)	EC mm (in.)	H mm (in.)	L mm (in.)	L with brake mm (in.)	LB mm (in.)	L-LB mm (in.)	M mm (in.)	R mm x mm (in. x in.)	S mm (in.)	SS mm (in.)	T mm (in.)
H-2005	80 (3.15)	11 (0.43) ²	18 (0.71)	12 (0.47)	15.2 (0.60)	75 (2.95)	220 (8.66)	—	197 (7.7)	23 (0.90) ³	60 (2.36) ¹	4 x 4 (0.16 x 0.16)	5.8 (0.23)	75 (2.95)	2.4 (0.09) ⁴
H-3007	89 (3.50)	14 (0.55) ²	20 (0.79)	15 (0.59)	10.9 (0.43)	75 (2.95)	202 (7.95)	211 (8.31)	172 (6.77)	30 (1.18) ³	80 (3.15) ¹	5 x 5 (0.20 x 0.20)	7 (0.28)	100 (3.94)	3 (0.12) ⁴
H-3016	89 (3.50)	14 (0.55) ²	20 (0.79)	15 (0.59)	10.9 (0.43)	75 (2.95)	253 (9.96)	262 (10.31)	223 (8.77)	30 (1.18) ³	80 (3.15) ¹	5 x 5 (0.20 x 0.20)	7 (0.28)	100 (3.94)	3 (0.12) ⁴
H-4030	121 (4.76)	19 (0.75) ²	40 (1.57)	20 (0.79)	15.5 (0.61)	76 (3.00)	263 (10.36)	266 (10.47)	213 (8.39)	50 (1.97) ³	110 (4.33) ⁵	6 x 6 (0.24 x 0.24)	10 (0.39)	145 (5.71)	3 (0.12) ⁴
H-4050	121 (4.76)	19 (0.75) ⁶	40 (1.57)	20 (0.79)	15.5 (0.61)	76 (3.00)	314 (12.37)	317 (12.48)	264 (10.39)	50 (1.97) ³	110 (4.33) ⁵	6 x 6 (0.24 x 0.24)	10 (0.39)	145 (5.71)	3 (0.12) ⁴

H-3000, -4000, -6000, and -8000 Motors Dimensions, Continued

Motor	AB mm (in.)	D mm (in.)	EA mm (in.)	EB mm (in.)	EC mm (in.)	H mm (in.)	L mm (in.)	L with brake mm (in.)	LB mm (in.)	L-LB mm (in.)	M mm (in.)	R (height x width) mm x mm (in. x in.)	S mm (in.)	SS mm (in.)	T mm (in.)
H-4075	121 (4.76)	19 (0.75) ⁶	40 (1.57)	20 (0.79)	15.5 (0.61)	76 (3.00)	365 (14.38)	368 (14.49)	315 (12.40)	50 (1.97) ³	110 (4.33) ⁵	6 x 6 (0.24 x 0.24)	10 (0.39)	145 (5.71)	3 (0.12) ⁴
H-6100	178 (7.01)	35 (1.38) ⁷	60 (2.36)	38 (1.50)	21.3 (0.84)	101 (4.00)	357 (14.06)	330 (12.99)	277 (10.91)	80 (3.15) ³	114.3 (4.50) ⁵	10 x 8 (0.39 x 0.31)	13.5 (0.53)	200 (7.87)	4 (0.16) ⁴
H-6200	178 (7.01)	35 (1.38) ⁷	60 (2.36)	38 (1.50)	21.3 (0.84)	101 (4.00)	433 (17.06)	406 (15.98)	353 (13.90)	80 (3.15) ³	114.3 (4.50) ⁵	10 x 8 (0.39 x 0.31)	13.5 (0.53)	200 (7.87)	4 (0.16) ⁴
H-6300	178 (7.01)	35 (1.38) ⁷	60 (2.36)	38 (1.50)	21.3 (0.84)	101 (4.00)	509 (20.05)	482 (17.40)	429 (16.89)	80 (3.15) ³	114.3 (4.50) ⁵	10 x 8 (0.39 x 0.31)	13.5 (0.53)	200 (7.87)	4 (0.16) ⁴
H-8350	241 (9.49)	42 (1.65) ⁷	60 (2.36)	45 (1.77)	22.4 (0.88)	112 (4.41)	460 (18.12)	478 (18.82)	375 (14.76)	85 (3.35) ³	230 (9.06) ⁸	12 x 8 (0.47 x 0.31)	15 (0.59)	265 (10.43)	4 (0.16) ⁴
H-8500	241 (9.49)	42 (1.65) ⁷	60 (2.36)	45 (1.77)	22.4 (0.88)	112 (4.41)	511 (20.13)	529 (20.83)	426 (16.77)	85 (3.35) ³	230 (9.06) ⁸	12 x 8 (0.47 x 0.31)	15 (0.59)	265 (10.43)	4 (0.16) ⁴

¹ Tolerance is -0.03 mm (-0.0012 in.).

² Tolerance is -0.01 mm (-0.0004 in.).

³ Tolerance is ±0.5 mm (±0.0196 in.).

⁴ Tolerance is ±0.2 mm (±0.0079 in.).

⁵ Tolerance is -0.035 mm (-0.0014 in.).

⁶ Tolerance is -0.013 mm (-0.0051 in.).

⁷ Tolerance is -0.16 mm (-0.0006 in.).

⁸ Tolerance is -0.46 mm (-0.0181 in.).

Supplemental Motor Dimensions

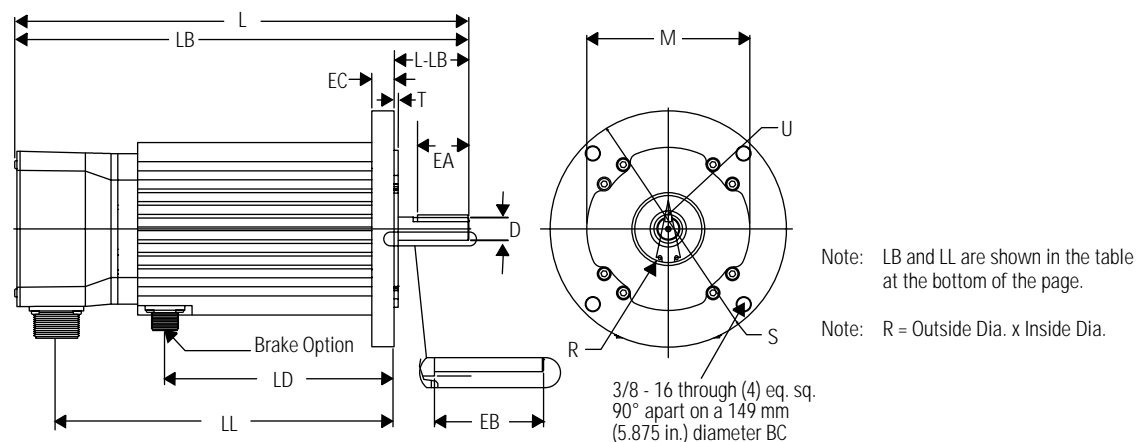
Motor	LD - Brake Connector mm (in.)	LL - Encoder Connector mm (in.)	LL - Power Connector mm (in.)
H-2005	—	167 (6.58)	167 (6.58)
H-3007 Brake	— 107 (4.21)	143 (5.63) 181 (7.13)	143 (5.63) 181 (7.13)
H-3016 Brake	— 158 (6.22)	194 (7.64) 232 (9.13)	194 (7.64) 232 (9.13)
H-4030 Brake	— 160 (6.30)	184 (7.24) 236 (9.29)	184 (7.24) 236 (9.29)
H-4050 Brake	— 211 (8.31)	235 (9.25) 287 (11.30)	235 (9.25) 287 (11.30)
H-4075 Brake	— 262 (10.31)	286 (11.26) 338 (13.30)	286 (11.26) 338 (13.30)
H-6100 Brake	— 189 (7.44)	251 (9.88) 299 (11.77)	251 (9.88) 299 (11.77)
H-6200 Brake	— 265 (10.43)	327 (12.87) 375 (14.76)	327 (12.87) 375 (14.76)
H-6300 Brake	— 341 (13.42)	403 (15.87) 451 (17.75)	403 (15.87) 451 (17.75)
H-8350 Brake	— 334 (13.13)	326 (12.83) 429 (16.83)	326 (12.83) 429 (16.83)
H-8500 Brake	— 384 (15.13)	377 (14.83) 480 (18.83)	377 (14.83) 480 (18.83)

H-4000 NEMA 56C Dimensions

The following section contains H-4000 NEMA 56 dimensions.

Figure 6.6

H-4000 Servo Motor Dimensions (H-2005-P-x0xAx)



Motor	D mm (in.)	EA mm (in.)	EB mm (in.)	EC mm (in.)	L mm (in.)	L (with brake) mm (in.)	LB mm (in.)	L-LB mm (in.)	M mm (in.)	R mm (in.)	S mm (in.)	T mm (in.)	U mm (in.)
H-4030 NEMA 56C	15.9 (0.625) ⁶	36 (1.41) full depth	50.8 (2)	15.5 (0.61)	265 (10.44)	266 (10.47)	213 (8.39)	52 (2.06) ¹	114.3 (4.5) ²	47 (1.850) x 20 (0.788) ⁴	165 (6.5)	3 (0.12) ³	4.8 (0.1875) width x 35 (1.375) depth ⁵
H-4050 NEMA 56C					316 (12.45)	317 (12.48)	264 (10.39)						
H-4075 NEMA 56C					367 (14.45)	368 (14.49)	315 (12.4)						

¹ Tolerance is ± 0.508 mm (± 0.02 in.)

² Tolerance is -0.0762 mm (-0.003 in.)

³ Tolerance is ± 0.254 mm (± 0.01 in.)

⁴ 7 mm (0.276 in.) shaft seal (optional)

⁵ Key is supplied.

⁶ Tolerance is -0.0127 mm (-0.0005 in.)

Supplemental NEMA Motors Dimensions

Motor	Brake Connector (LD) mm (in.)	Power Connector (LL) mm (in.)	Encoder Connector (LL) mm (in.)
H-4030 Brake	— 160 (6.30)	184 (7.24) 236 (9.29)	184 (7.24) 236 (9.29)
H-4050 Brake	— 211 (8.31)	235 (9.25) 287 (11.30)	235 (9.25) 287 (11.30)
H-4075 Brake	— 262 (10.31)	286 (11.26) 338 (13.30)	286 (11.26) 338 (13.30)

Load Force Ratings

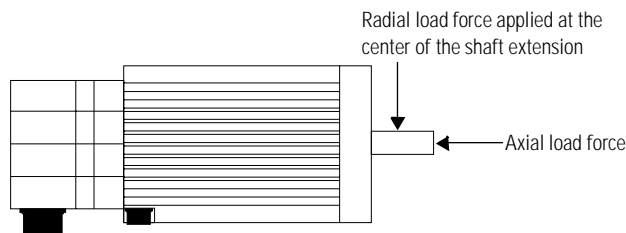
The following section contains the H-Series motor radial and axial load force ratings.

Motor	500 RPM kg (lb)	1000 RPM kg (lb)	2000 RPM kg (lb)	3000 RPM kg (lb)	4000 RPM kg (lb)	5000 RPM kg (lb)	6000 RPM kg (lb)
H-2005	63.5 (140)	50.8 (112)	39.9 (88)	34.9 (77)	31.8 (70)	29.5 (65)	20.4 (45)
H-3007	68.0 (150)	54.4 (120)	43.1 (95)	37.6 (83)	34.0 (75)	31.8 (70)	—
H-3016	76.2 (168)	60.8 (134)	47.6 (105)	41.7 (92)	38.1 (84)	35.4 (78)	—
H-4030-M	102.1 (225)	91.6 (202)	72.6 (160)	63.5 (140)	57.6 (127)	—	—
H-4030-P	102.1 (225)	91.6 (202)	72.6 (160)	63.5 (140)	57.6 (127)	—	—
H-4050	123.8 (273)	98.9 (218)	78.0 (172)	68.0 (150)	62.1 (137)	—	—
H-4075	129.7 (286)	104.3 (230)	82.6 (182)	71.2 (156)	65.3 (144)	—	—
H-6100	263.1 (580)	208.7 (460)	165.6 (365)	145.2 (320)	—	—	—
H-6200	283.5 (625)	226.8 (500)	179.2 (395)	156.5 (345)	—	—	—
H-6300	299.4 (660)	235.9 (520)	188.2 (415)	163.3 (360)	—	—	—
H-8350	299.4 (660)	238.1 (525)	188.2 (415)	—	—	—	—
H-8500	313.0 (690)	249.5 (550)	197.3 (435)	—	—	—	—

Motors are capable of carrying an axial load in most applications according to the following general guidelines. These guidelines should only be used as approximations.

Figure 6.7

H-Series Motor Load Forces (H-xxxx-P-x0xAx)



- With no radial load, the axial load rating is 100% of the radial load rating from the table above.
- With a radial and an axial load, the axial load rating is 44% of the radial load rating from the table above.

Brake Specifications and Application Guidelines

The following section contains the H-Series brake motor specifications and application guidelines.

Specifications

Motor Series	Maximum backlash (brake engaged) minutes	Holding torque N-m (lb-in.)	Coil current at 24V DC Amps	Coil current at 90V DC Amps
H-3000	30	2.26 (20)	0.6	0.21
H-4000	44	10.2 (90.27)	0.88	0.26
H-6000	29	22.6 (200)	1.13	0.33
H-8000	21	50.8 (449.58)	2.2	0.62

Application Guidelines

The brakes offered as options on these servo motors are holding brakes designed to hold the motor shaft at 0 rpm up to the rated brake holding torque. The spring-set type brakes release when voltage is applied to the brake coil.

The brakes are *not* designed for stopping rotation of the motor shaft. Servo drive inputs should be used to stop motor shaft rotation. The recommended method of stopping motor shaft rotation is to command the servo drive to decelerate the motor to 0 rpm, and engage the brake after the servo drive has decelerated the motor to 0 rpm.

If system main power fails, the brakes can withstand use as stopping brakes. However, use of the brakes as stopping brakes creates rotational mechanical backlash that is potentially damaging to the system, increases brake pad wear and reduces brake life. The brakes are *not* designed nor are they intended to be used as a safety device.

A separate power source is required to disengage the brake. This power source can be controlled by the servo motor controls, in addition to manual operator controls.

Encoder Data

The following section contains the H-Series encoder specifications and outputs.

Encoder Specifications

Specification	Description
Line Count	2000 lines/revolution ¹
Supply Voltage	5V DC
Supply Current	250 mA maximum
Line Driver	26LS31
Line Driver Output	TTL
Index Pulse	H-2000 and H-3000 Series when key faces 180°±10 away from the connectors
	H-4000, H-6000 and H-8000 Series when key faces the connectors (0°±10)

¹ Standard line count before quadrature.

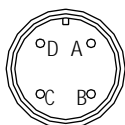
Note: Encoders are factory aligned and must not be adjusted outside the factory.

Connector Data

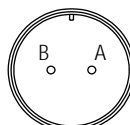
The following section contains the power, brake, and encoder connector pins and signals.

Power Connector and Optional Motor Brake Connector

Power Connector	
Pin	Signal
A	U
B	V
C	W
D	Motor Case



Brake Connector	
Pin	Signal
A	BR+
B	BR-



Encoder Connector

Pin	Signal	Pin	Signal
A	A+	K	+5V DC
B	A-	L	COM
C	B+	M	COM
D	B-	N	Hall B
E	I+	P	Hall C
F	I-	R	TS+
G	Encoder Case	S	TS-
H	ABS	T	Hall A
J	+5V DC		



Wire Sizing Recommendations

The following section contains the wire sizing recommendations for the H-Series power, encoder and brake connectors.

Connectors

Motor	Power Connector	Motor	Encoder Connector	Motor	Brake Connector
	Wire ¹ mm ² (AWG)		Wire mm ² (AWG)		Wire mm ² (AWG)
H-2005	1.5 ² (16)	H-2005	0.324 ² (22)	H-2005	0.75 ² (18)
H-3007		H-3007		H-3007	
H-3016		H-3016		H-3016	
H-4030		H-4030		H-4030	
H-4050	2.5 ² (14)	H-4050		H-4050	
H-4075		H-4075		H-4075	
H-6100	4 ² (12)	H-6100		H-6100	
H-6200	10 ² (8)	H-6200		H-6200	
H-6300		H-6300		H-6300	
H-8350	16 ² (6)	H-8350		H-8350	
H-8500		H-8500		H-8500	

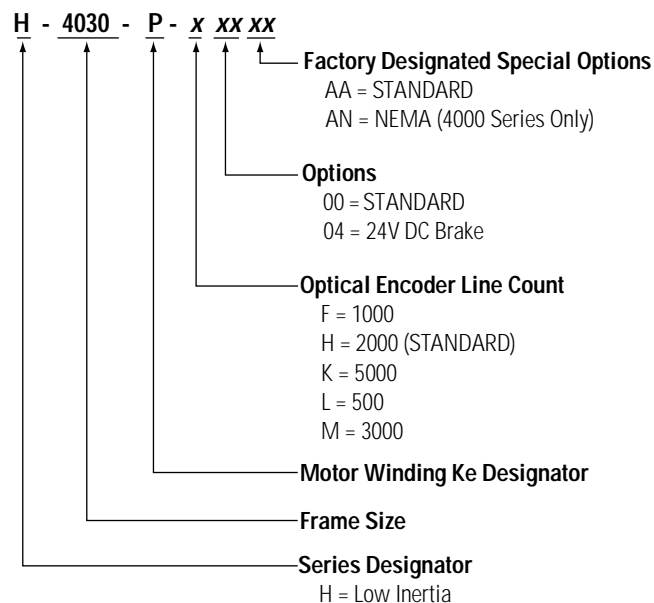
¹ Sizes are recommended minimum values for 4 conductors (U, V, W and GND).

Note: Wiring should be twisted, and local observations should always be observed.

Note: These specifications are the recommended minimum mechanical size.

H-Series Motor Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering table chart below to understand the configuration of your motor. For questions regarding product availability, contact your Allen-Bradley distributor.



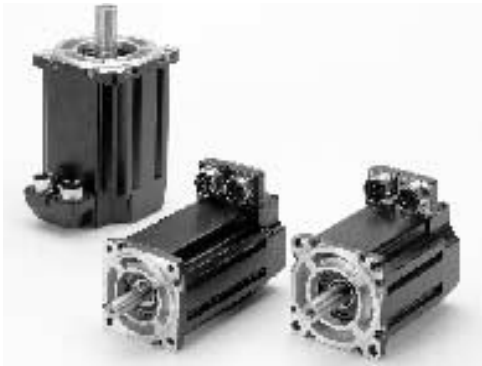
Note: Optional configurations or encoder line counts have extended lead times and additional charges.

Note: Options are not available in all sizes.

Note: 5000-line count encoder, motor top speed is limited to 3600 RPM due to frequency output limit of encoder. Check drive system configuration data for any additional restrictions imposed by drive input.

Note: For H-6000 series motors, the top speed is limited to 2400 RPM due to frequency output limit of encoder. Check drive system configuration data for any additional restrictions imposed by drive input.

MP-Series Motors



MP-Series low-inertia, brushless servo motors feature a newly engineered construction that reduces motor size while delivering significantly higher torque.

Each servo motor features:

- 230V or 460V motor windings.
- A segmented core stator design that allows for the maximum amount of copper winding material in a smaller area for more output with a given current input.
- Improved winding encapsulation material for enhanced thermal management and heat transfer, resulting in higher performance.
- High-energy neodymium (NeFeB) magnets for a maximum torque-to-inertia ratio and, consequently, quicker motor acceleration and deceleration.
- Speeds up to 5000 rpm.
- Automatic configuration of motor parameters within the drive for simplified set up and peak performance.
- Multiple electronic configurations within a frame size for optimal servo system capabilities with a less powerful drive, potentially reducing costs.
- Easily reversible motor connectors for compatibility with various applications and minimal servo motor impact on machine design considerations.
- Internal thermal protection sensor to prevent motor damage.
- IP-66 rating for environmentally rugged motor with shaft seal installed (no motor disassembly required).
- Maximized shaft diameter for increased strength.
- Standard IEC mounting dimensions.
- UL listed insulation system for increased torque-producing current.

Note: For drive compatibility, refer to the Motor Selection Chart in *Preface*.

MP-Series Standard Encoder Features

MP-Series motors are available with a 2000-line high-performance encoder. This standard encoder features:

- 2000-line quadrature output encoder that delivers 8,000 counts per revolution for precise position feedback.
- Bearingless construction.

MP-Series Options

MP-Series motors are available with the following options:

- Shaft oil seal kit available for field installation.
- Multi-turn high-resolution encoder.
- Two-pole resolver-based feedback.
- Single-turn high-resolution encoder.
- High resolution of 2,000,000 counts per revolution on the standard 2000-line high-performance encoder.
- 24V DC brake.
- Keyless shaft.

230V General Specifications

The following section contains the 230V MP-Series performance, winding, mechanical, storage/operating, and thermostat specifications.

Ultra5000 and Ultra3000 Performance Specifications for MP-Series Motors

Motor MPL-	Drives		Maximum Speed rpm (with 230V AC Line Voltage Input)	Continuous Torque N-m (lb-in.)	Peak Torque N-m (lb-in.)	System Continuous Stall Current Amperes	System Peak Stall Current Amperes	Motor Rated Output kW	Rotor Moment of Inertia kg-m ² (lb-in.-s ²)
	2098-IPD ¹	2098-DSD- ²							
A310P	005	005	4750	0.79 (7)	1.98 (17.5)	2.5	7.5	0.30	0.000042 (0.00037)
	010	010		1.58 (14)	3.61 (32)	5	15	0.73	
A310F	005	005	3000	1.32 (11.7)	3.61 (32)	2.5	9	0.27	0.000042 (0.00037)
	010	010		1.58 (14)		3		0.46	
A320P	005	005	4750	0.82 (7.2)	2.20 (19.4)	2.5	7.5	0.32	0.000076 (0.00067)
	010	010		1.63 (14.4)	4.39 (38.9)	5	15	0.64	
	020	020		2.94 (26)	7.34 (65)	9	26	1.3	
A320H	005	005	3350	1.13 (10)	4.03 (35.6)	2.5	7.5	0.36	0.000076 (0.00067)
	010	010		2.94 (26)	7.34 (65)	5	15	0.75	
A330P	020	020	5000	3.48 (30.8)	11.1 (98)	10	30	1.8	0.00011 (0.00097)
	—	030		4.18 (37)					
A420P	020	020	5000	3.65 (32.3)	13.5 (120)	10	30	1.68	0.00026 (0.0023)
	—	030		4.74 (42)		13	46	2.2	
A430P	020	020	5000	6.55 (58)	19.8 (175)	10	30	1.62	0.00038 (0.0034)
	—	030				18	62	2.4	
A430H	020	020	3500	5.04 (44.6)	19.8 (175)	10	30	1.69	0.00038 (0.0034)
	—	030		6.55 (58)		13	45	2.2	
A4520P	020	020	5000	3.39 (30)	9.04 (80)	10	30	2.4	0.00027 (0.0024)
	—	075		6.1 (54)	13.5 (120)	18	48		
A4520K	020	020	4000	4.36 (38.6)	13.5 (120)	10	30	1.49	0.00027 (0.0024)
	—	030		6.1 (54)		14	37	2.1	
A4530K	020	020	4000	4.18 (37)	20.3 (180)	10	30	1.33	0.00038 (0.0034)
	—	075		8.36 (74)		20	62	2.6	
A4530F	020	020	2800	6.43 (56.9)	20.3 (180)	10	30	1.43	0.00038 (0.0034)
	—	075		8.36 (74)		13	40	1.8	
A4540F	020	020	3000	5.65 (50)	27.1 (240)	10	30	2.8	0.00050 (0.0044)
	—	075		10.2 (90)		18	52		

¹ These specifications also apply to Ultra5000 drives equipped with the DeviceNet option.

² These specifications also apply to Ultra3000 drives equipped with the indexing, SERCOS, DeviceNet, or indexing DeviceNet options.

Mechanical Specifications

Motor MPL-	Specifications		
	Motor Weight kg (lb)	Motor Shipping Weight kg (lb)	Shaft Material
A310P	2.6 (5.7)	3 (6.6)	Grade 1144 Steel
A310F			
A320P	3.6 (7.9)	4 (8.8)	
A320H			
A330P	4.6 (10)	5 (11)	
A420P	4.2 (9.3)		
A430P	5.5 (12)	6.4 (14)	
A430H			
A4520P	5.9 (13)	6.8 (15)	
A4520K			
A4530K	7.3 (16)	8.2 (18)	
A4530F			
A4540F	8.6 (19)	9.5 (2.1)	

Winding Specifications

Motor MPL-	Specifications				
	Torque Constant ¹ N-m (lb-in.)	Voltage Constant ² volts/1000 rpm	Terminal Resistance ³ ohms	Inductance ⁴ mH	Poles
A310P	0.43 (3.80)	52	4.7	25	8
A310F	0.66 (5.85)	80	12	55	
A320P	0.43 (3.80)	52	1.8	12	
A320H	0.59 (5.27)	72	3.9	24	
A330P	0.43 (3.80)	52	1.2	7.5	
A420P			1	5.6	
A430P			0.63	3.6	
A430H	0.63 (5.56)	76	1.3	7.5	
A4520P	0.43 (3.80)	52	0.58	5.6	
A4520K	0.51 (4.54)	62	0.88	7.6	
A4530K			0.51	4.7	
A4530F	0.76 (6.73)	92	1.2	12	
A4540F	0.71 (6.29)	86	0.75	7.5	

¹ This KT was sine wave at 20° to 30° C (68° to 86° F).

² 0 to peak value of volts, phase to phase.

³ Phase to phase at 20° to 30° C (68° to 86° F).

⁴ Phase to phase.

Storage and Operating Specifications

Specification	Description
Ambient Temperature	0° to 40° C (32° to 104° F)
Storage Temperature	-30° to 70° C (-22° to 158° F)
Relative Humidity	5% to 95% non-condensing
Shock	20g peak, 6 ms duration
Vibration	2.5g, 30-2000 Hz

Thermostat Specifications

Specification	Description
Rated voltage	230V AC maximum
Rated current	2.5A at power factor of 1.0; 1.6A at power factor of 0.6
Maximum switching current	5A
Contact resistance	1 Ohms maximum
Contacts	Normally closed
Insulation dielectric	Power Connections (U, V and W) to ground; 1800V AC RMS 50/60 Hz for one second
Opening temperature	155° C (311° F)

460V General Specifications

The following section contains the 460V MP-Series performance, winding, mechanical, storage/operating, and thermostat specifications.

Performance Specifications

Motor ¹	Rated Speed rpm		Motor Rated Torque N-m (lb-in.)	Motor Rated Output kW	Rotor Inertia kg-m ² (lb-in.-s ²)	System Continuous Torque N-m (lb-in.)	System Peak Stall Torque N-m (lb-in.)	System Continuous Stall Current ⁴ Amperes	System Peak Stall Current ⁴ Amperes	1394 Axis Module
	460V	380V								
MPL-B310P	5000	4500	1.58 (14)	0.72	0.000064 (0.00056)	1.58 (14)	2.48 (21.95)	2.40	4.30	AM03
MPL-B320P	5000	4500	2.94 (26)	1.3	0.000098 (0.00087)	2.77 (24.52) ²	4.52 (40)	4.24	7.10	AM03
						2.94 (26.02)		4.50		AM04
MPL-B330P	5000	4500	4.18 (37)	1.7	0.00014 (0.0012)	2.91 (25.71) ²	5.62 (49.77) ³	4.24	8.50	AM03
						4.18 (36.99)	6.55 (57.97)	6.10	9.90	AM04
										AM07
MPL-B420P	5000	4500	4.74 (42)	1.9	0.00028 (0.0025)	3.14 (27.79) ²	5.62 (49.71) ³	4.24	8.50	AM03
						4.74 (41.95)	8.39 (74.27) ³	6.40	12.70	AM04
							8.59 (76.02)		13.00	AM07
MPL-B430P	5000	4000	6.55 (58)	2.4	0.00040 (0.0035)	3.02 (26.72) ²	5.90 (52.22) ³	4.24	8.50	AM03
						4.56 (40.33) ²	8.82 (78.02) ³	6.40	12.70	AM04
						6.55 (57.97)	11.80 (104.43)	9.20	17.00	AM07
MPL-B4520P	5000	4600	6.10 (54)	2.5	0.00030 (0.0026)	3.04 (26.93) ²	4.78 (42.31) ³	4.24	8.50	AM03
						4.59 (40.65) ²	7.14 (63.22) ³	6.40	12.70	AM04
						6.10 (53.99)	11.81 (104.54) ³	8.50	21.00	AM07
							13.50 (119.48)		24.00	AM50
MPL-B4530F	3000	3000	8.36 (74)	2.2	0.00042 (0.0037)	4.99 (44.18) ²	8.32 (73.64) ³	4.24	8.50	AM03
						7.54 (66.69) ²	12.43 (110.03) ³	6.40	12.70	AM04
						8.36 (73.99)	18.60 (164.61)	7.10	19.00	AM07
MPL-B4530K	4000	4000	8.36 (74)	2.6	0.00042 (0.0037)	3.22 (28.52) ²	5.86 (51.82) ³	4.24	8.50	AM03
						4.86 (43.05) ²	8.75 (77.43) ³	6.40	12.70	AM04
						8.06 (71.30) ²	14.47 (128.03) ³	10.60	21.00	AM07
						8.36 (73.99)	18.60 (164.61)	11.00	27.00	AM50

Performance Specifications, Continued

Motor Catalog Number ¹	Rated Speed rpm		Motor Rated Torque N-m (lb-in.)	Motor Rated Output kW	Rotor Inertia kg-m ² (lb-in.-s ²)	System Continuous Torque N-m (lb-in.)	System Peak Stall Torque N-m (lb-in.)	System Continuous Stall Current ⁴ Amperes	System Peak Stall Current ⁴ Amperes	1394 Axis Module
	460V	380V								
MPL-B4540F	3000	3000	10.2 (90)	3.0	0.00054 (0.0048)	4.75 (42.06) ²	8.76 (77.51) ³	4.24	8.50	AM03
						7.17 (63.49) ²	13.09 (115.82) ³	6.40	12.70	AM04
						10.20 (90.27)	21.64 (191.51) ³	9.10	21.00	AM07
							23.70 (209.75)		23.00	AM50

¹ All ratings are for 40° C (104° F) motor ambient, 110° C (212° F) case, 50° C (122° F) amplifier ambient and 40° C (104° F) external heatsink ambient (AM50 and AM75). For extended ratings at lower ambients contact Allen-Bradley.

² Limited by axis module continuous current.

³ Limited by axis module peak current.

⁴ Continuous and peak stall current values are 0 to peak.

Mechanical Specifications

Motor MPL-	Specifications		
	Motor Weight kg (lb)	Motor Shipping Weight kg (lb)	Shaft Material
B310P	2.7 (5.8)	3.1 (6.7)	Grade 1144 Steel
B320P	3.7 (8)	4.1 (8.9)	
B330P	4.6 (10)	5 (11)	
B420P	4.3 (9.4)	5 (11)	
B430P	5.5 (12)	6.4 (14)	
B4520P	5.9 (13)	6.8 (15)	
B4530F	7.3 (16)	8.2 (18)	
B4530K			
B4540F	8.6 (19)	9.5 (21)	

Winding Specifications

Motor MPL-	Specifications				
	Torque Constant ¹ N-m (lb-in.)	Voltage Constant ² volts/1000 rpm	Terminal Resistance ³ ohms	Inductance ⁴ mH	Poles
B310P	0.794 (7.03)	86.4 to 105.6	18 to 22	93	8
B320P			6.75 to 8.25	42	
B330P			4.14 to 5.06	28	
B420P	0.827 (7.32)	90 to 110	3.42 to 4.18	21	
B430P			2.07 to 2.53	13	
B4520P	0.794 (7.03)	86.4 to 105.6	2.34 to 2.86	21	
B4530F	1.49 (13.2)	162 to 198	3.78 to 4.62	41	
B4530K	0.951 (8.42)	103.5 to 126.5	1.8 to 2.2	18	
B4540F	1.33 (11.8)	145.8 to 178.2	2.88 to 3.52	30	

¹ This KT was sine wave at 20° to 30° C (68° to 86° F).

² 0 to peak value of volts, phase to phase at 20° to 30° C (68° to 86° F).

³ Phase to phase at 20° to 30° C (68° to 86° F).

⁴ Phase to phase.

Storage and Operating Specifications

Specification	Description
Ambient Temperature	0° to 40° C (32° to 104° F)
Storage Temperature	-30° to 70° C (-22° to 158° F)
Relative Humidity	5% to 95% non-condensing
Shock	20g peak, 6 ms duration
Vibration	2.5g, 30-2000 Hz

Thermostat Specifications

Specification	Description
Rated voltage	250V AC maximum
Rated current	2.5A at power factor of 1.0; 1.6A at power factor of 0.6
Maximum switching current	5A
Contact resistance	1 Ohms maximum
Contacts	Normally closed
Insulation dielectric	Power Connections (U, V and W) to ground; 2350V AC RMS 50/60 Hz for one second
Opening temperature	155° C (311° F)

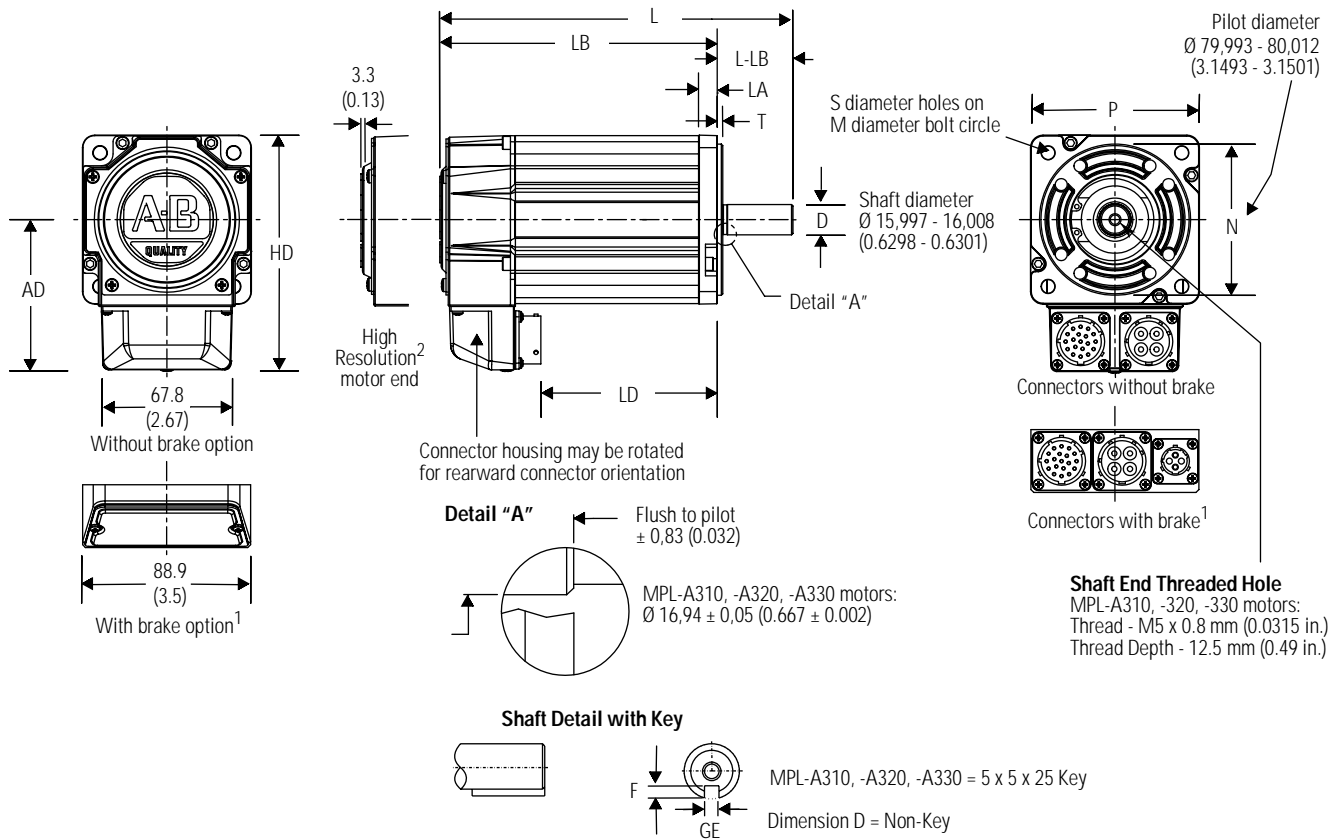
Motors Dimensions

The following section contains the dimensions for 230V and 460V MP-Series motors.

230V Servo Motors Dimensions

Figure 6.8

230V MP-Series Servo Motors Dimensions (MPL-A3xx-HK2xAA)



Motor Series	AD mm (in.)	HD mm (in.)	L-LB mm (in.)	T mm (in.)	LA mm (in.)	LD mm (in.)	L mm (in.)	LB mm (in.)	L-LB mm (in.)	D mm (in.)	M mm (in.)	S mm (in.)	N mm (in.)	P mm (in.)	F mm (in.)	GE mm (in.)
MPL-A310						70.7 (2.78)	164.7 (6.49)	124.7 (4.91)								
A320	80.9 (3.19)	125.7 (4.95)	40 (1.58) ³	2.87 (0.113)	9.9 (0.39)	96.1 (3.78)	190.1 (7.49)	150.1 (5.91)	40 (1.576)	16 (0.061)	100 (3.937)	7 (0.28) ⁴	80 (3.15)	89.4 (3.52)	3 (0.12) ⁵	5 (0.2) ⁶
A330						121.5 (4.78)	215.5 (8.49)	175.5 (6.91)								

¹ If ordering an MPL-A310, -A320, or -A330 motor with brake, add 34.5 mm (1.36 in.) to dimensions L, LB, and LD.

² If ordering an MPL-A310, -A320, or -A330 motor with high-resolution feedback, add 3.3 mm (0.13 in.) to dimensions L and LB.

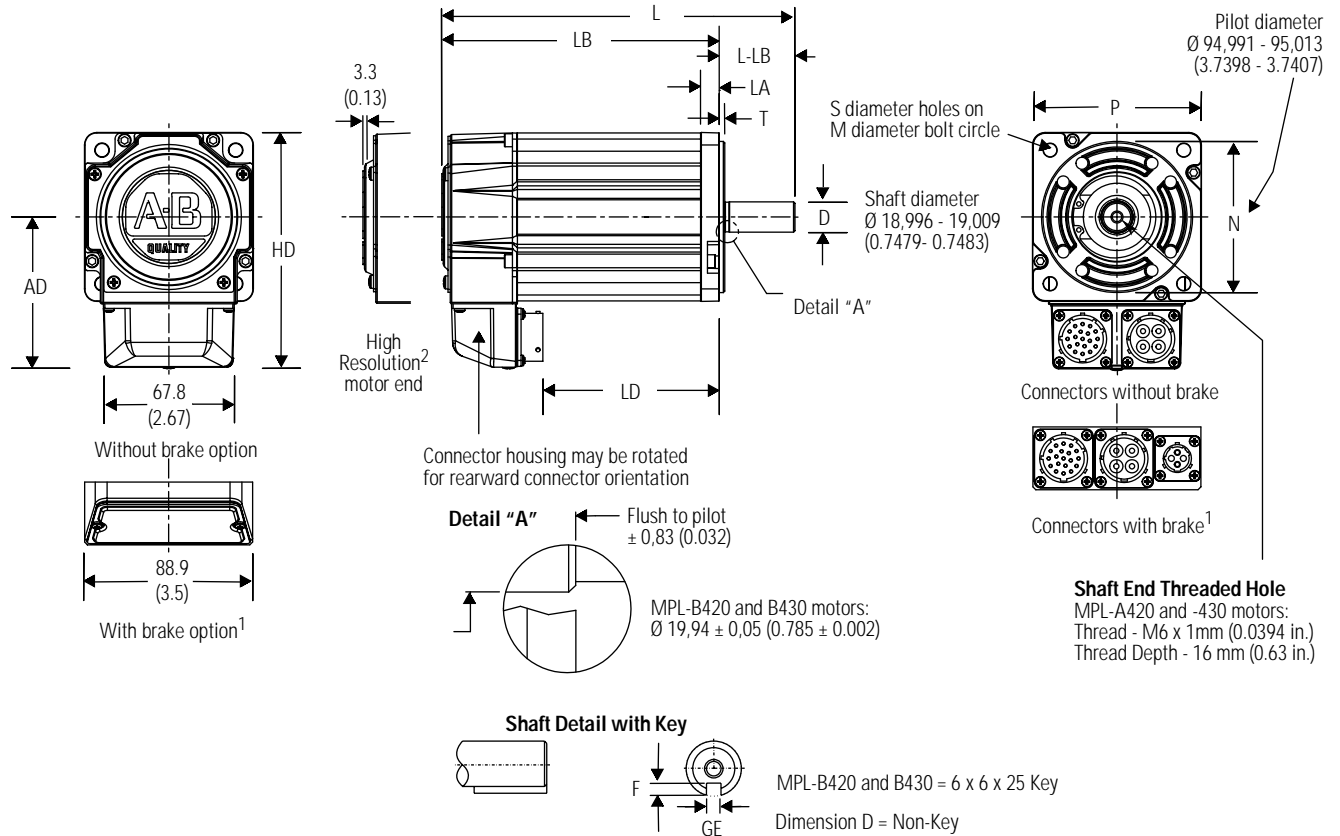
³ Tolerance for this dimension is ±0.7 (±0.028).

⁴ Tolerance for this dimension is +0.36 (±0.007).

⁵ Tolerance for this dimension is +0.1 (+0.004).

⁶ Tolerance for this dimension is -0.03 (-0.001).

Figure 6.9
230V MP-Series Servo Motors Dimensions (MPL-A4xx-HK2xAA)



Motor Series	AD mm (in.)	HD mm (in.)	L-LB mm (in.)	T mm (in.)	LA mm (in.)	LD mm (in.)	L mm (in.)	LB mm (in.)	L-LB mm (in.)	D mm (in.)	M mm (in.)	S mm (in.)	N mm (in.)	P mm (in.)	F mm (in.)	GE mm (in.)
MPL-A420	83.9 (3.30)	132.8 (5.23)	40 (1.58) ³	2.87 (0.113)	10.2 (0.4)	92.5 (3.64)	186.5 (7.35)	146.5 (5.77)	40 (1.576)	19 (0.748)	115 (4.528)	10 (0.41) ⁴	95 (3.74)	98.3 (3.87)	3.5 (0.14) ⁵	6 (0.2) ⁶
MPL-A430						117.9 (4.64)	211.9 (8.35)	171.9 (6.77)								

¹ If ordering an MPL-A420 or -A430 motor with brake, add 48.5 mm (1.91 in.) to dimensions L, LB, and LD.

² If ordering an MPL-A420 or -A430 motor with high-resolution feedback, add 3.3 mm (0.13 in.) to dimensions L and LB.

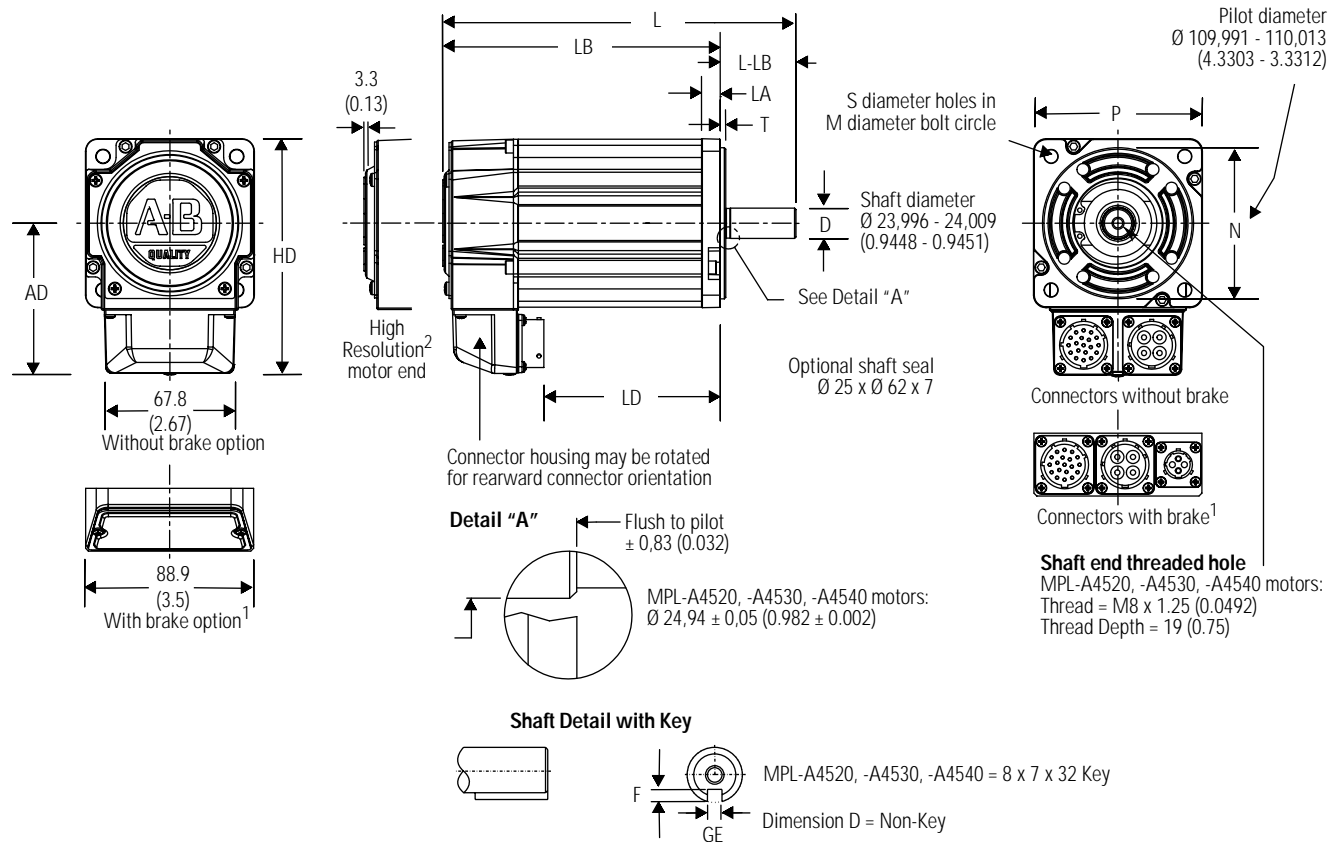
³ Tolerance for this dimension is ±0.7 (±0.028).

⁴ Tolerance for this dimension is +0.36 (±0.007).

⁵ Tolerance for this dimension is +0.1 (+0.004).

⁶ Tolerance for this dimension is -0.03 (-0.001).

Figure 6.10
230V MP-Series Servo Motors Dimensions (MPL-A45xx-HK2xAA)



Motor Series	AD mm (in.)	HD mm (in.)	L-LB mm (in.)	T mm (in.)	LA mm (in.)	LD mm (in.)	L mm (in.)	LB mm (in.)	L-LB mm (in.)	D mm (in.)	M mm (in.)	S mm (in.)	N mm (in.)	P mm (in.)	F mm (in.)	GE mm (in.)
MPL-A4520						95.8 (3.77)	199.8 (7.87)	149.8 (5.90)								
A4530	91.5 (3.6)	148.3 (5.84)	50 (1.97) ³	3.38 (0.133)	12.2 (0.48)	121.2 (4.77)	225.2 (8.87)	175.2 (6.90)	50 (1.97)	24 (0.945)	130 (5.118)	10 (0.41) ⁴	110 (4.331)	113.7 (4.48)	4 (0.16) ⁵	8 (0.3) ⁶
A4540						146.6 (5.77)	250.6 (9.87)	200.6 (7.90)								

¹ If ordering an MPL-A4520, -A4530, or -A4540 motor with brake, add 48.5 mm (1.91 in.) to dimensions L, LB, and LD.

² If ordering an MPL-A4520, -A4530, or -A4540 motor with high-resolution feedback, add 3.3 mm (0.13 in.) to dimensions L and LB.

³ Tolerance for this dimension is ±0.7 (±0.028).

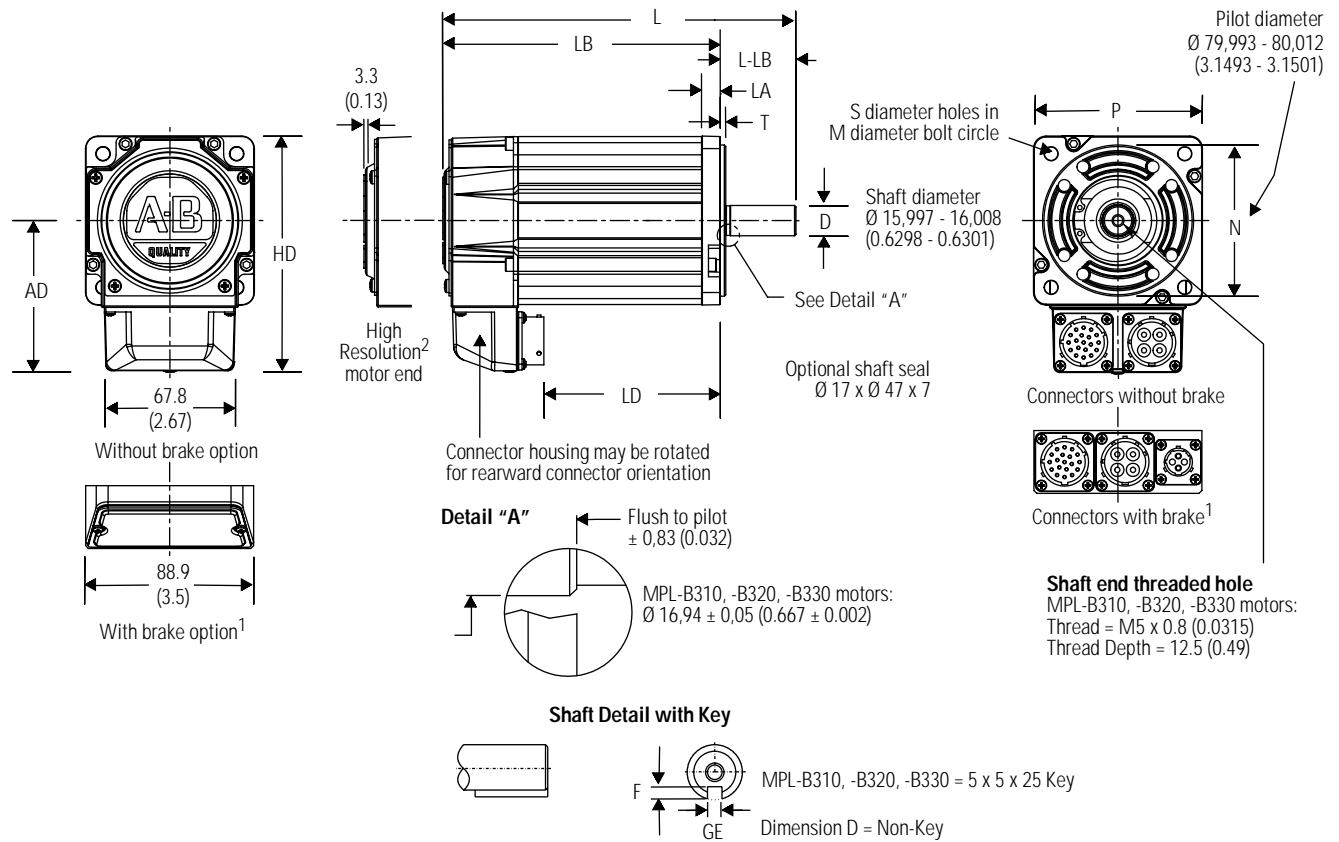
⁴ Tolerance for this dimension is ±0.36 (±0.007).

⁵ Tolerance for this dimension is ±0.2 (±0.007).

⁶ Tolerance for this dimension is -0.03 (-0.001).

460V Motors Dimensions

Figure 6.11
460V MP-Series Servo Motors Dimensions (MPL-B3xx-HK2x-AA)



Motor Series	AD mm (in.)	HD mm (in.)	L-LB mm (in.)	T mm (in.)	LA mm (in.)	LD mm (in.)	L mm (in.)	LB mm (in.)	L-LB mm (in.)	D mm (in.)	M mm (in.)	S mm (in.)	N mm (in.)	P mm (in.)	F mm (in.)	GE mm (in.)
MPL-B310						70.7 (2.78)	164.7 (6.49)	124.7 (4.91)								
B320	80.9 (3.19)	125.7 (4.95)	40 (1.58) ³	2.87 (0.113)	9.9 (0.39)	96.1 (3.78)	190.1 (7.49)	150.1 (5.91)	40 (1.576)	16 (0.061)	100 (3.937)	7 (0.28) ⁴	80 (3.15)	89.4 (3.52)	3 (0.12) ⁵	5 (0.2) ⁶
B330						121.5 (4.78)	215.5 (8.49)	175.5 (6.91)								

¹ If ordering an MPL-B310, -B320, or -B330 motor with brake, add 34.5 mm (1.36 in.) to dimensions L, LB, and LD.

² If ordering an MPL-B310, -B320, or -B330 motor with high-resolution feedback, add 3.3 mm (0.13 in.) to dimensions L and LB.

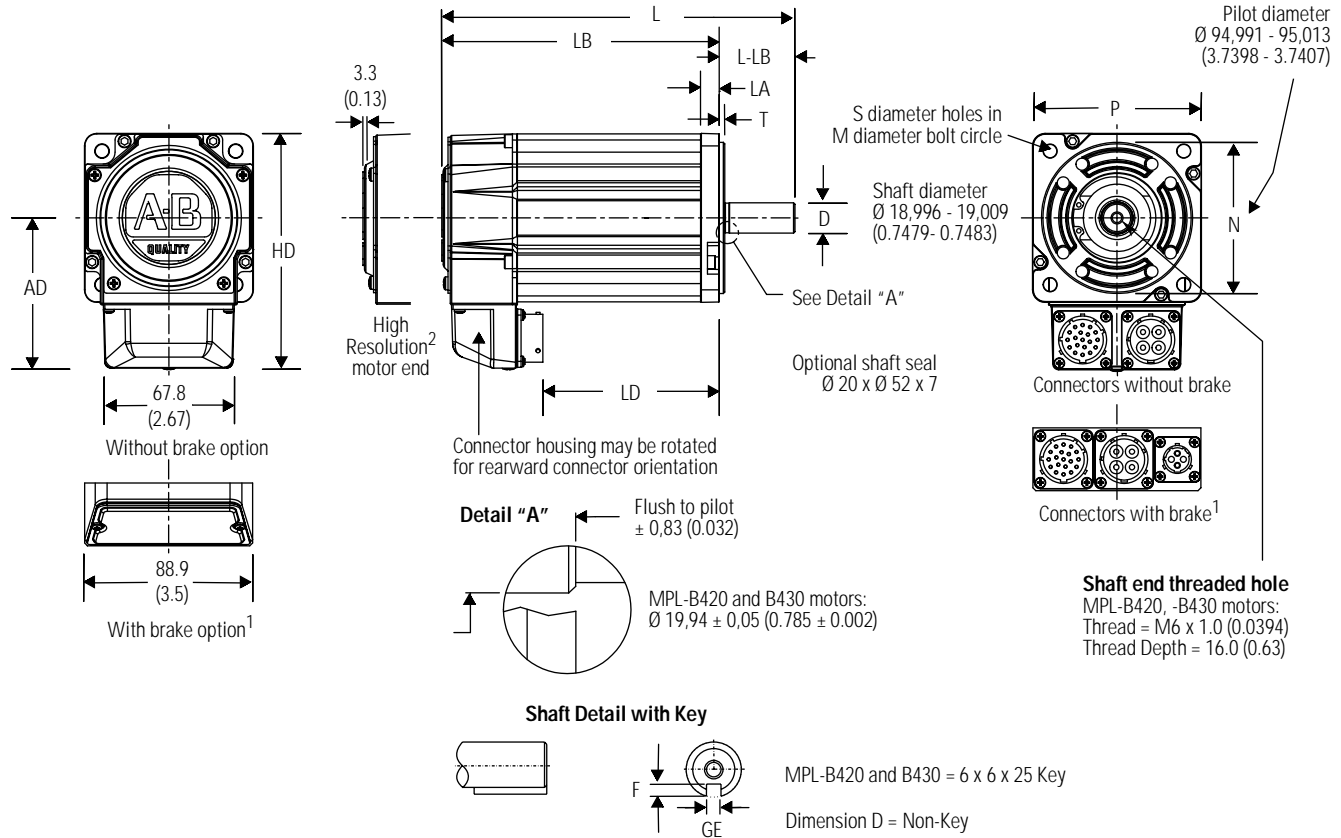
³ Tolerance for this dimension is ±0.7 (±0.028).

⁴ Tolerance for this dimension is +0.36 (±0.007).

⁵ Tolerance for this dimension is +0.1 (+0.004).

⁶ Tolerance for this dimension is -0.03 (-0.001).

Figure 6.12
460V MP-Series Servo Motors Dimensions (MPL-B4xx-HK2x-AA)



Motor Series	AD mm (in.)	HD mm (in.)	L-LB mm (in.)	T mm (in.)	LA mm (in.)	LD mm (in.)	L mm (in.)	LB mm (in.)	L-LB mm (in.)	D mm (in.)	M mm (in.)	S mm (in.)	N mm (in.)	P mm (in.)	F mm (in.)	GE mm (in.)
B420	83.9 (3.3)	132.8 (5.23)	40 (1.58) ³	2.87 (0.113)	10.2 (0.4)	92.5 (3.64)	186.5 (7.35)	146.5 (5.77)	40 (1.576)	19 (0.748)	115 (4.528)	10 (0.41) ⁴	95 (3.74)	98.3 (3.87)	3.5 (0.14) ⁵	6 (0.2) ⁶
B430						117.9 (4.64)	211.9 (8.35)	171.9 (6.77)								

¹ If ordering an MPL-B420 or -B430 motor with brake, add 48.5 mm (1.91 in.) to dimensions L, LB, and LD.

² If ordering an MPL-B420 or -B430 motor with high-resolution feedback, add 3.3 mm (0.13 in.) to dimensions L and LB.

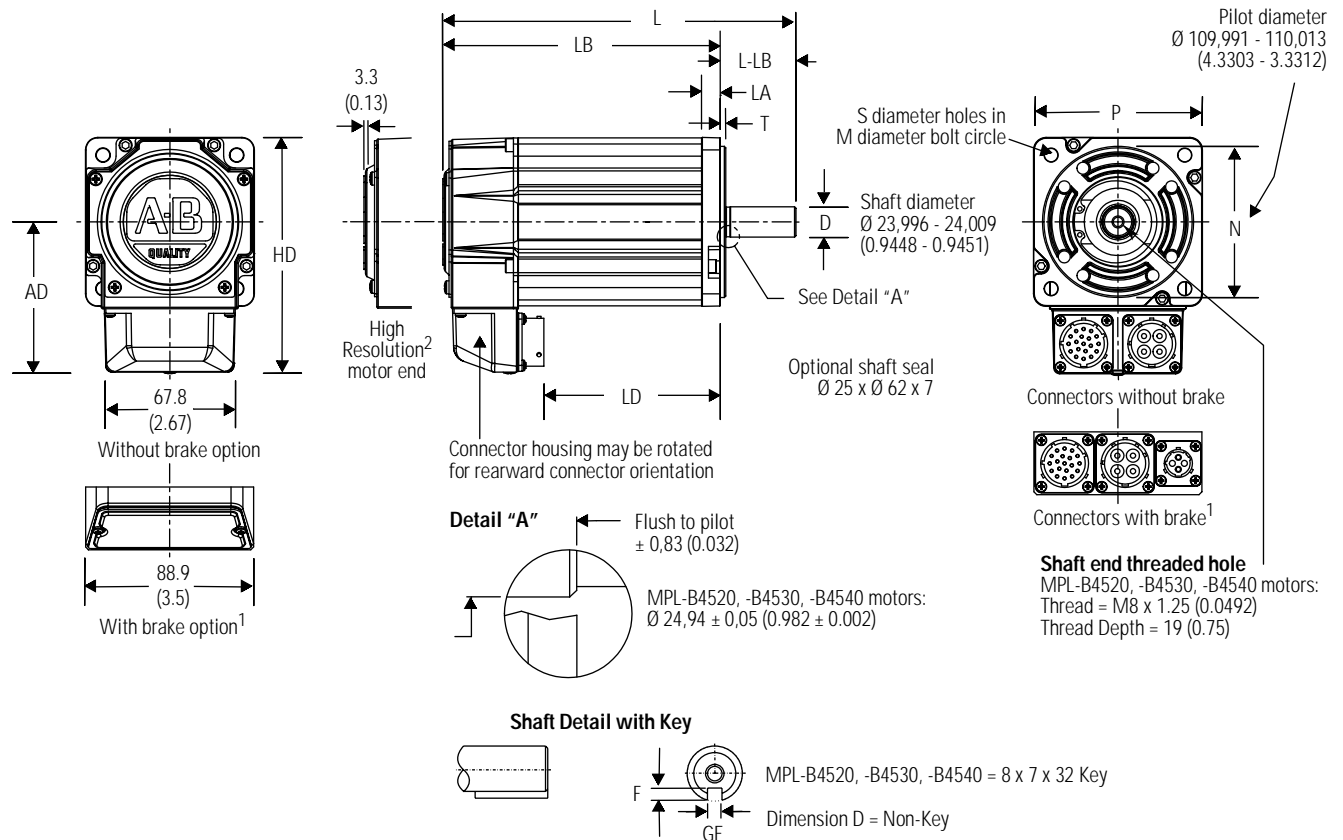
³ Tolerance for this dimension is ± 0.7 (± 0.028).

⁴ Tolerance for this dimension is ± 0.36 (± 0.007).

⁵ Tolerance for this dimension is ± 0.1 (± 0.004).

⁶ Tolerance for this dimension is ± 0.03 (± 0.001).

Figure 6.13
460V MP-Series Servo Motors Dimensions (MPL-B45xx-HK2x-AA)



Motor Series	AD mm (in.)	HD mm (in.)	L-LB mm (in.)	T mm (in.)	LA mm (in.)	LD mm (in.)	L mm (in.)	LB mm (in.)	L-LB mm (in.)	D mm (in.)	M mm (in.)	S mm (in.)	N mm (in.)	P mm (in.)	F mm (in.)	GE mm (in.)
MPL-B4520						95.8 (3.77)	199.8 (7.87)	149.8 (5.90)								
MPL-B4530	91.5 (3.6)	148.3 (5.84)	50 (1.97) ³	3.38 (0.133)	12.2 (0.48)	121.2 (4.77)	225.2 (8.87)	175.2 (6.90)	50 (1.97)	24 (0.945)	130 (5.118)	10 (0.41) ⁴	110 (4.331)	113.7 (4.48)	4 (0.16) ⁵	8 (0.3) ⁶
MPL-B4540						146.6 (5.77)	250.6 (9.87)	200.6 (7.90)								

¹ If ordering an MPL-B4520, -B4530, or -B4540 motor with brake, add 48.5 mm (1.91 in.) to dimensions L, LB, and LD.

² If ordering an MPL-B4520, -B4530, or -B4540 motor with high-resolution feedback, add 3.3 mm (0.13 in.) to dimensions L and LB.

³ Tolerance for this dimension is ±0.7 (±0.028).

⁴ Tolerance for this dimension is +0.36 (±0.007).

⁵ Tolerance for this dimension is +0.2 (±0.007).

⁶ Tolerance for this dimension is -0.03 (-0.001).

Load Force Ratings

The following section contains the 230V and 460V MP-Series radial and axial motor load force ratings. MP-Series motors are capable of operating with the maximum radial or maximum axial shaft loads listed in the following tables. Radial loads listed are applied in the middle of the shaft extension. The tables below represent an L10 bearing fatigue life of 20,000 hours. This 20,000-hour life does not account for possible application-specific life reduction that may occur due to bearing grease contamination from external sources.

Radial Load Force Ratings

Motor Series MPL-A- and MPL-B-	500 rpm kg (lb)	1000 rpm kg (lb)	2000 rpm kg (lb)	3000 rpm kg (lb)	3500 rpm kg (lb)	4000 rpm kg (lb)	5000 rpm kg (lb)
310	78 (172)	62 (137)	49 (108)	–	40 (88)	–	36 (79)
320	87 (192)	69 (152)	55 (121)	–	45 (99)	–	40 (88)
330	–	74 (163)	59 (130)	–	49 (108)	–	43 (95)
420	–	78 (172)	62 (137)	–	51 (112)	–	45 (99)
430	106 (234)	84 (185)	67 (148)	–	55 (121)	–	49 (108)
4520	–	97 (214)	77 (170)	67 (148)	64 (141)	61 (134)	56 (123)
4530	133 (293)	105 (232)	84 (185)	73 (161)	–	66 (146)	–
4540	140 (309)	111 (245)	89 (196)	77 (170)	–	–	–

Axial Load Force Ratings (Maximum Radial Load)

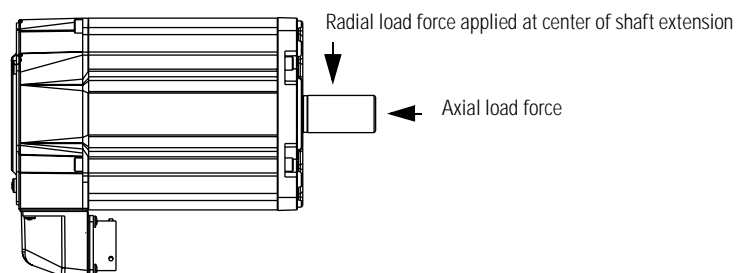
Motor Series MPL-A- and MPL-B-	500 rpm kg (lb)	1000 rpm kg (lb)	2000 rpm kg (lb)	3000 rpm kg (lb)	3500 rpm kg (lb)	4000 rpm kg (lb)	5000 rpm kg (lb)
310	30 (66)	23 (51)	16 (35)	–	13 (29)	–	11 (24)
320	34 (75)	25 (55)	19 (42)	–	15 (33)	–	13 (29)
330	–	27 (60)	20 (44)	–	16 (35)	–	13 (29)
420	–	36 (79)	27 (60)	–	21 (46)	–	18 (40)
430	52 (115)	39 (86)	29 (64)	–	22 (49)	–	19 (42)
4520	–	31 (68)	23 (51)	19 (42)	18 (40)	17 (37)	15 (33)
4530	45 (99)	34 (75)	25 (55)	21 (46)	–	19 (42)	–
4540	49 (108)	36 (79)	27 (60)	22 (49)	–	–	–

Axial Load Force Ratings (Zero Radial Load)

Motor Series MPL-A- and MPL-B-	500 rpm kg (lb)	1000 rpm kg (lb)	2000 rpm kg (lb)	3000 rpm kg (lb)	3500 rpm kg (lb)	4000 rpm kg (lb)	5000 rpm kg (lb)
310	49 (108)	36 (79)	27 (60)	–	21 (46)	–	18 (40)
320	49 (108)	36 (79)	27 (60)	–	21 (46)	–	18 (40)
330	–	36 (79)	27 (60)	–	21 (46)	–	18 (40)
420	–	51 (112)	38 (84)	–	30 (66)	–	25 (55)
430	69 (152)	51 (112)	38 (84)	–	30 (66)	–	25 (55)
4520	–	51 (112)	38 (84)	31 (68)	30 (66)	28 (62)	25 (55)
4530	69 (152)	51 (112)	38 (84)	31 (68)	–	28 (62)	–
4540	69 (152)	51 (112)	38 (84)	31 (68)	–	–	–

Figure 6.14

MP-Series Motor Load Forces (MPL-xxxxx-HK2xAA)



- With no radial load, the axial load rating is 100% of the radial load rating from the table above.
- With both a radial and an axial load, the axial load rating is 44% of the radial load rating from the table above.

Encoder Data

The following section contains the MP-Series encoder specifications.

Encoder Specifications

Specification	Description
A+, A-, B+, B- Line Count	2000
S1, S2, S3 Commutation Line Count	4
Quadrature Count	8000 (with 2000 line standard encoder)
Supply Voltage	5V DC $\pm 5\%$: 4.75-5.25V DC, 200 mA DC maximum
Supply Current	200 mA maximum
Line Driver	TTL
A+, A-, B+, B-Line Driver Output	Logic 1 = 2.5V DC minimum at 20 mADC source Logic 0 = 0.5V DC maximum at 20 mADC sink
S1, S2, S3 Output	Logic 1 = 3.5V DC minimum at 1 mADC source Logic 0 = 0.5V DC maximum at 20 mADC sink
Index Pulse	I+, I- (gated with A+, B+)
Alignment	I+ (when the optional shaft keyway faces the connector to within $\pm 10^\circ$)
ABS Output	1 mADC maximum source

Brake Specifications and Application Guidelines

The following section contains the MP-Series brake motor specifications and application guidelines.

Specifications

Motor MPL-A and MPL-B	Maximum backlash (brake engaged) minutes	Holding Torque N-m (lb-in.)	Coil Current at 24V DC Amps
310	45	4.18 (37)	0.5
320			
330			
420	37	10.2 (90)	0.6 to 0.7
430			
4520			
4530			
4540			

Application Guidelines

The brakes offered as options on these servo motors are holding brakes designed to hold the motor shaft at 0 rpm up to the rated brake holding torque. The spring-set type brakes release when voltage is applied to the brake coil.

The brakes are *not* designed for stopping rotation of the motor shaft. Servo drive inputs should be used to stop motor shaft rotation. The recommended method of stopping motor shaft rotation is to command the servo drive to decelerate the motor to 0 rpm, and engage the brake after the servo drive has decelerated the motor to 0 rpm.

If system main power fails, the brakes can withstand use as stopping brakes. However, use of the brakes as stopping brakes creates rotational mechanical backlash that is potentially damaging to the system, increases brake pad wear and reduces brake life. The brakes are *not* designed nor are they intended to be used as a safety device.

A separate power source is required to disengage the brake. This power source can be controlled by the servo motor controls, in addition to manual operator controls.

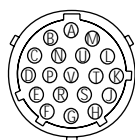
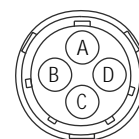
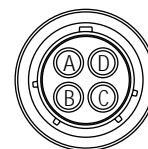
Connector Data

The following section contains the 230V and 460V MP-Series encoder and power connector pins and signals.

Encoder, Power and Brake Connectors

2000 Line Encoder Connector		2 Pole Resolver Encoder Connector	High Resolution for 230 VAC Motor Encoder Connector	High Resolution for 460 VAC Motor Encoder Connector
Pin	Signal	Signal	Signal	Signal
A	A+	S2	Sin+	Sin+
B	A-	S4	Sin-	Sin-
C	B+	S1	Cos+	Cos+
D	B-	S3	Cos-	Cos-
E	I+	Reserved	Data+	Data+
F	I-		Data-	Data-
G	Ground	R1	Reserved	Reserved
H	ABS	R2		
J	Reserved	Reserved	+5 VDC	
K	+5 VDC		Common	
L	Common		Reserved	
M	Reserved			Common
N				
P				
R	TS+	TS+	TS+	TS+
S	TS-	TS-	TS-	TS-
T	S1	Reserved	Reserved	Reserved
U	S2			
V	S3			

Power Connector		Brake Connector	
Pin	Signal	Pin	Signal
A	Phase U	A	BR+
B	Phase V	B	Reserved
C	Phase W	C	BR-
D	Ground	D	Reserved



Wire Sizing Recommendations

The following section contains the wire sizing recommendations for the 230V and 460V MP-Series power, encoder and brake connectors.

Connectors

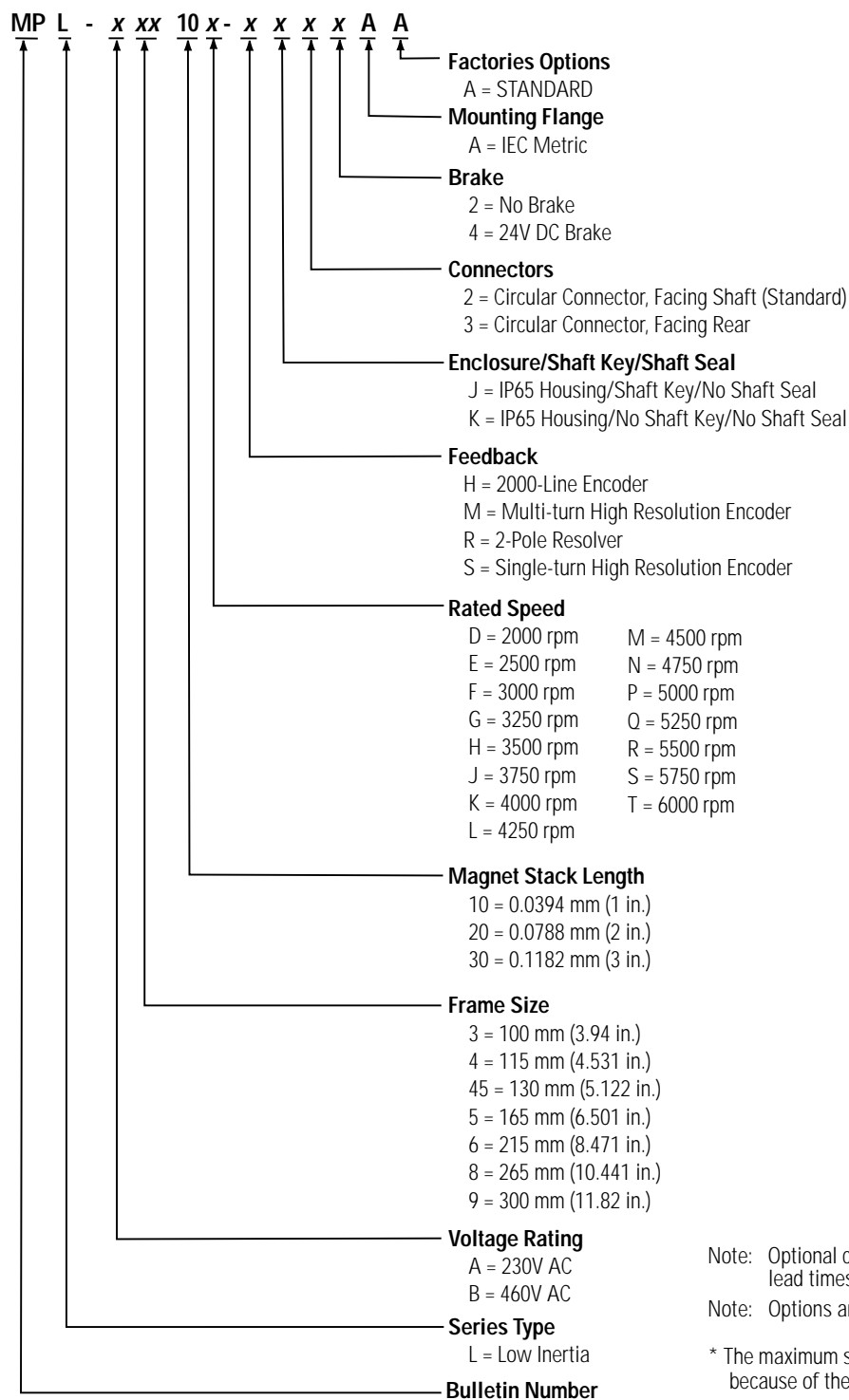
Motor Series MPL-A and MPL-B	Power Connector	Motor Series MPL-A and MPL-B	Encoder Connector	Motor Series MPL-A and MPL-B	Brake Connector
	Wire ¹ mm ² (AWG)		Wire mm ² (AWG)		Wire mm ² (AWG)
310	1.5 ² (16)	310	0.324 ² (22) 1.5 ² (16)	310	0.08 ² (28) 2.5 ² (14)
320		320		320	
330		330		330	
420	2.5 ² (14)	420		420	
430		430		430	
4520	4 ² (12)	4520		4520	
4530		4530		4530	

¹ Sizes are recommended minimum values for 4 conductors (U, V, W and GND).

Note: Wiring should be twisted, and local regulations should always be observed.

MP-Series Motor Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering table chart below to understand the configuration of your motor. For questions regarding product availability, contact your Allen-Bradley distributor.



Note: Optional configurations or encoder line counts have extended lead times and additional charges.

Note: Options are not available in all sizes.

* The maximum speed with the 5000-Line encoder is 2400 RPM because of the frequency output limit of the encoder.

N-Series Motors



N-Series motors are used in medium inertia applications such as semiconductor manufacturing, material handling, web processing, robotics and packaging machinery.

Each of these servo motors features:

- NEMA 23, 34, 42, and 56 style mounting frames.
- Continuous torque from 0.18 to 5.9 N-m (1.6 to 52 lb-in.).
- Speeds up to 6000 RPM.
- High torque-to-size ratio.
- High energy ring magnet rotor.
- Internal thermal switch to prevent overheating.
- Optional internally mounted spring set, magnetic release 24V DC holding brake.
- Motor-mounted optical encoder featuring 2000 quadrature pulses (1000 pulses for N-23xx motors), index pulse, and standard commutation channels for drives.
- Water-tight, nickel-plated MS connections are compatible with standard cable assemblies.
- Extruded aluminum housing and environmental connectors providing an IP65 rating with shaft seal installed.

Note: For drive compatibility, refer to the Motor Selection Chart in *Preface*.

General Specifications

The following section contains the N-Series performance, mechanical, winding, storage/operating, and thermostat specifications.

Ultra5000 and Ultra3000 Performance Specifications for N-Series Motors¹

Motor	Drives		Maximum speed ⁴ rpm	Continuous stall torque ⁵ N·m (lb-in.)	Peak torque N·m (lb-in.)
	2098-IPD- ²	2098-DSD- ³			
N-2302	005	005	6000	0.2 (1.6)	0.5 (4.6)
N-2304	005	005	6000	0.4 (3.5)	1.1 (10)
	010	010		0.5 (4.4)	1.4 (13)
N-3406	010	010	6000	0.8 (6.8)	2.1 (18.5)
N-3412	010	010	5500	1.5 (13)	4.1 (36)
N-4214	010	010	4500	2.0 (15.5)	5.7 (45)
N-4220	020	020	5000	2.5 (22)	7.1 (63)
	—	030		2.9 (26)	
N-5630	020	020	4000	3.4 (30)	10.7 (95)
	—	030		3.8 (34)	
N-5637	020	020	4000	4.5 (40)	13 (120)
	—	030		5.2 (46)	
N-5647	020	020	3000	5.9 (52)	17.0 (150)
	—	030		6 (53)	

¹ Ambient temperature is 0° C to 40° C (32° F to 104° F) for motors and 0° C to 50° C (32° F to 122° F) for drives.

² These specifications also apply to Ultra5000 drives equipped with the DeviceNet option.

³ These specifications also apply to Ultra3000 drives equipped with the indexing or SERCOS interface options.

⁴ With 230V AC line voltage input, except for N-2302 and N-2304, which are used with 115V AC line voltage input.

⁵ System limit.

Mechanical Specifications

Motor	Rotor moment of inertia kg-m ² (lb-in.-s ²)	Rotor moment of inertia (brake motors) kg-m ² (lb-in.-s ²)	Motor Shipping Weight kg (lb)	Motor net weight kg (lb)	Brake motor net weight kg (lb)	Damping N-m/kRPM (lb-in./kRPM)	Friction torque N-m (lb-in.)
N-2302	0.000009 (0.00008)	0.00001 (0.00009)	1.3 (2.8)	1 (2.3)	1.3 (2.9)	0.0007 (0.006)	0.012 (0.11)
N-2304	0.000023 (0.0002)	0.000023 (0.00021)	1.8 (4)	1.5 (3.4)	2.0 (4.3)	0.0014 (0.013)	0.025 (0.22)
N-3406	0.000071 (0.00063)	0.000076 (0.00068)	3 (6.7)	2.8 (6.2)	3.4 (7.5)	0.0078 (0.069)	0.021 (0.19)
N-3412	0.00121 (0.000137)	0.000142 (0.00126)	4 (8.7)	3.5 (7.6)	4.3 (9.5)	0.012 (0.106)	0.035 (0.31)
N-4214	0.000194 (0.00172)	0.000198 (0.00176)	5.2 (11.4)	4.7 (10.4)	5.1 (11.2)	0.013 (0.113)	0.046 (0.41)
N-4220	0.000276 (0.00244)	0.00028 (0.00248)	6.7 (14.7)	6.4 (14)	6.9 (15.2)	0.012 (0.106)	0.056 (0.5)
N-5630	0.000636 (0.00563)	0.000651 (0.00576)	9.6 (21.1)	9.5 (21)	10.9 (24)	0.022 (0.194)	0.085 (0.75)
N-5637	0.000763 (0.00675)	0.000778 (0.00689)	11.7 (25.7)	11.3 (25)	13.2 (29)	0.02 (0.175)	0.1 (0.875)
N-5647	0.000878 (0.00777)	0.000893 (0.00791)	13.8 (30.3)	13.2 (29)	15.9 (33)	0.028 (0.25)	0.11 (1)

Winding Specifications

Motor	Sine wave K _T torque constant at 25° C (77° F) ¹ N-m/A (lb-in./A)	K _E voltage constant ² V/kRPM	Winding resistance phase to phase at 25° C (77° F) Ohms	Winding inductance phase to phase mH	Thermal resistance ³ °C/Watt	Poles
N-2302	0.1 (0.85)	10	3.18	4.1	3	4
N-2304	0.21 (1.9)	22	4.9	8.1	2.2	
N-3406	0.2 (1.8)	21	2.2	6.1	1.6	
N-3412	0.38 (3.4)	40	2.7	8.6	1.2	
N-4214	0.44 (3.9)	46	2.9	11	1.1	
N-4220	0.32 (2.8)	33	0.81	2.9	0.81	
N-5630	0.45 (4)	47	0.94	4.3	0.94	
N-5637	0.56 (5)	60	1	5.2	0.76	
N-5647	0.75 (6.6)	78	1.23	5.9	0.70	

¹ Peak value of per phase sine wave amps.

² Peak value of sinusoidal phase to phase volts.

³ At 125° C (257° F) winding temperature, in a 40° C (104° F) ambient, with motor mounted on aluminum heat sinks:
motors 2302, 2304—0.25 in. x 8 in. x 8 in.; motors 3406, 3412—0.25 in. x 10 in. x 10 in.;
motors 4214, 4220, 5630, 5637, 5647—0.5 in. x 12 in. x 12 in.

Storage and Operating Specifications

Specification	Description
Ambient Temperature	Operating: 0° to 40° C (32° to 104° F) Storage: 0° to 50° C (32° to 122° F)
Relative Humidity	5% to 95% non-condensing

Thermostat Specifications

Specification	Description
Rated voltage	0 - 250V DC or 50/60 Hz AC ¹
Rated current	2.5A at power factor of 1.0; 1.6A at power factor of 0.6
Maximum switching current	5A
Contact resistance	Less than 0.050 Ohms maximum
Contacts	Normally closed
Insulation dielectric	Mylar Nomex capable of withstanding 1500V AC RMS 50/60 Hz for 1 minute
Opening temperature $\pm 5^{\circ}\text{C}$ ($\pm 9^{\circ}\text{F}$)	135° C (275° F)

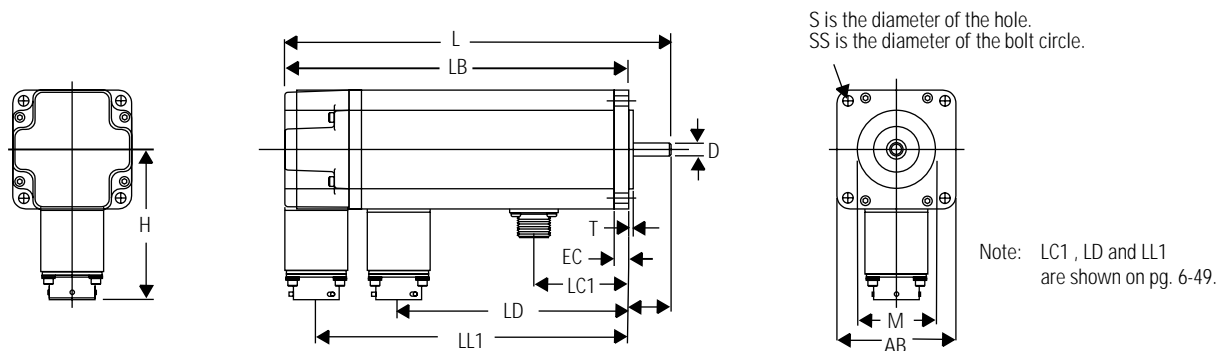
¹ The thermostat is normally used as a switch for a 15V DC logic signal (recommended).

Motor Dimensions

The following section contains the dimensions for the N-Series motors.

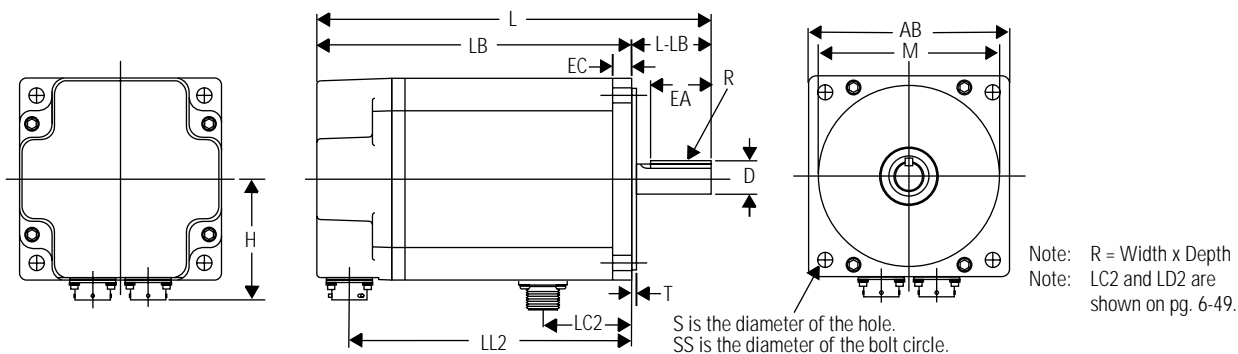
N-2300 Motors Dimensions

Figure 6.15
N-2300 Servo Motors Dimensions (N-230x-x-x0xAA)



N-3400, -4200 and -5600 Motors Dimensions

Figure 6.16
N-3400, -4200 and -5600 Servo Motors Dimensions (N-xxxx-x-x0xAA)



Motor	AB mm (in.)	D mm (in.)	EA mm (in.)	EC mm (in.)	H mm (in.)	L mm (in.)	L with brake mm (in.)	LB mm (in.)	L-LB mm (in.)	M mm (in.)	R mm x mm (in. x in.)	S mm (in.)	SS mm (in.)	T mm (in.)
N-2302	57.66 (2.27)	6.35 (0.25) ³	—	6.98 (0.27)	69.85 (2.75)	138.27 (5.44)	161.3 (6.35)	117.7 (4.63)	20.57 (0.81) ¹	38.1 (1.5) ²	—	5.2 (0.2)	66.67 (2.62)	2.29 (0.09)
N-2304	57.66 (2.27)	6.35 (0.25) ³	—	6.985 (0.27)	69.85 (2.75)	176.37 (6.94)	199.4 (7.8)	155.8 (6.13)	20.57 (0.81) ¹	38.1 (1.5) ²	—	5.2 (0.2)	66.67 (2.62)	2.29 (0.09)
N-3406	88.4 (3.48)	12.7 (0.5) ³	19.05 (0.75) ⁶	8 (0.31)	62.99 (2.48)	174.25 (6.86)	192.8 (7.6)	144.02 (5.67)	30.23 (1.19) ¹	73.02 (2.87) ⁴	3.17 x 2 (0.125 x 0.085) ⁵	5.59 (0.22)	98.42 (3.87)	3.05 (0.12)
N-3412	88.4 (3.48)	12.7 (0.5) ³	19 (0.75) ⁶	8 (0.31)	62.9 (2.48)	199.65 (7.86)	218.19 (8.59)	169.42 (6.67)	30.23 (1.19) ¹	73.02 (2.87) ⁴	3.17 x 2 (0.125 x 0.085) ⁵	5.59 (0.22)	98.42 (3.87)	3.05 (0.12)

N-3400, -4200 and -5600 Motors Dimensions, Continued

Motor	AB mm (in.)	D mm (in.)	EA mm (in.)	EC mm (in.)	H mm (in.)	L mm (in.)	L with brake mm (in.)	LB mm (in.)	L-LB mm (in.)	M mm (in.)	R mm x mm (in. x in.)	S mm (in.)	SS mm (in.)	T mm (in.)
N-4214	101.6 (4)	15.87 (0.625) ³	23.9 (0.94) ⁶	10 (0.4)	62.23 (2.45)	208.92 (8.23)	220.73 (8.69)	173.87 (6.84)	35.05 (1.38) ¹	55.55 (2.19) ⁷	4.76 x 3 (0.187 x 0.123) ⁵	7.11 (0.28)	125.73 (4.95)	3.05 (0.12)
N-4220	101.6 (4)	15.87 (0.625) ³	23.9 (0.94) ⁶	10 (0.4)	62.23 (2.45)	234.32 (9.23)	245.87 (9.68)	199.27 (7.84)	35.05 (1.38) ¹	55.55 (2.19) ⁷	4.76 x 3 (0.187 x 0.123) ⁵	7.11 (0.28)	125.73 (4.95)	3.05 (0.12)
N-5630	127 (5)	19 (0.75) ³	38.1 (1.5) ⁶	12 (0.5)	75.18 (2.96)	248.79 (9.8)	255.52 (10.06)	198.75 (7.82)	50.04 (1.97) ¹	114.3 (4.5) ⁸	4.76 x 3 (0.187 x 0.121) ⁵	9.52 (0.37) in UNC	149.22 (5.87)	3.05 (0.12)
N-5637	127 (5)	19 (0.75) ³	38.1 (1.5) ⁶	12 (0.5)	75.18 (2.96)	274.19 (10.8)	280.92 (11.06)	224.15 (8.82)	50.04 (1.97) ¹	114.3 (4.5) ⁸	4.76 x 3 (0.187 x 0.121) ⁵	9.52 (0.37) in UNC	149.22 (5.87)	3.05 (0.12)
N-5647	127 (5)	19 (0.75) ³	38.1 (1.5) ⁶	12 (0.5)	75.18 (2.96)	299.59 (11.8)	306.32 (12.06)	249.55 (9.82)	50.04 (1.97) ¹	114.3 (4.5) ⁸	4.76 x 3 (0.187 x 0.121) ⁵	9.52 (0.37) in UNC	149.22 (5.87)	3.05 (0.12)

¹ Tolerance is ± 0.76 mm (± 0.03 in.).⁵ Tolerance is $+0.05$ mm ($+0.002$ in.) width, -0.36 mm (-0.014 in.) depth.² Tolerance is -0.05 mm (-0.002 in.).⁶ Tolerance is $+1.5$ mm ($+0.06$ in.).³ Tolerance is -0.013 mm (-0.0005 in.) diameter.⁷ Tolerance is -0.025 mm (-0.001 in.) diameter.⁴ Tolerance is -0.15 mm (-0.006 in.).⁸ Tolerance is -0.076 mm (-0.003 in.) diameter.

Supplemental N-Series Motors Dimensions

Motor	Brake Connector		Encoder Connector	Power Connector	
	LC1 mm (in.)	LC2 mm (in.)	LD mm (in.)	LL1	LL2
N-2302	105.156 (4.14)	—	102.9 (4)	61.7 (2.43)	—
N-2304	143.256 (5.64)	—	141 (5.5)	99.8 (4)	—
N-3406	—	4.490 (0.177)	—	—	123.7 (4.8)
N-3412	—	5.490 (0.216)	—	—	149.1 (5.87)
N-4214	—	5.694 (0.224)	—	—	152.15 (5.99)
N-4220	—	6.694 (0.263)	—	—	177.55 (6.99)
N-5630	—	170.104 (6.697)	—	—	177.8 (7)
N-5637	—	195.504 (7.697)	—	—	203.2 (8)
N-5647	—	220.904 (8.697)	—	—	228.6 (9)

Load Force Ratings

The following section contains the N-Series motor radial load force ratings and shaft load force ratings.

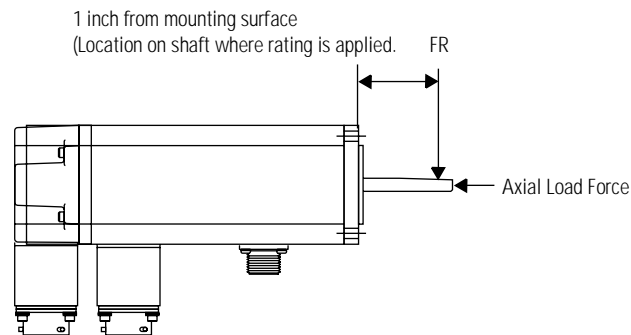
Motor	500 RPM kg (lb)	1000 RPM kg (lb)	2000 RPM kg (lb)	3000 RPM kg (lb)	4000 RPM kg (lb)	5000 RPM kg (lb)	6000 RPM kg (lb)
N-2302	8 (18)	7 (15)	6 (13)	6 (13)	5 (11)	4 (9)	3 (7)
N-2304	9 (20)	8 (18)	7 (15)	6 (13)	5 (11)	5 (11)	3 (7)
N-3406	47 (104)	37 (82)	29 (64)	26 (57)	23 (51)	22 (48)	20 (44)
N-3412	51 (112)	40 (88)	32 (71)	28 (62)	26 (57)	24 (53)	22 (48)
N-4214	62 (137)	49 (108)	39 (86)	34 (75)	31 (68)	29 (64)	—
N-4220	66 (146)	52 (115)	41 (90)	36 (79)	33 (73)	31 (68)	—
N-5630	85 (187)	67 (148)	53 (117)	47 (104)	43 (95)	—	—
N-5637	89 (196)	71 (157)	56 (123)	49 (108)	45 (99)	—	—
N-5647	92 (203)	73 (161)	58 (128)	51 (112)	—	—	—

Motors are capable of carrying an axial load in most applications according to the following general guidelines. These guidelines should only be used as approximations.

Shaft Load Force Ratings

Figure 6.17

N-Series Motor Load Forces (N-xxxx-x-x0xAA)



- With no radial load, the axial load rating is 100% of the radial load rating from the table above.
- With a radial and an axial load, the axial load rating is 44% of the radial load rating from the table above.

Motor Series	Shaft Radial Load (FR) kg (lb)
N-2300	2.26 (5)
N-3406	13.6 (30)
N-3412	15.9 (35)
N-4214	20.4 (45)

Brake Specifications and Application Guidelines

The following section contains the N-Series brake motor specifications and motor application guidelines.

Specifications

Motor Series	Maximum Backlash (brake engaged) minutes	Holding Torque N-m (lb-in.)	Coil Current at 24V DC Amps
N-2300	31	0.56 (5)	0.28
N-3400	72	1.69 (15)	0.37
N-4200	36	3.39 (30)	0.37
N-5600	102	5.64 (50)	0.71

Application Guidelines

The brakes offered as options on these servo motors are holding brakes designed to hold the motor shaft at 0 rpm up to the rated brake holding torque. These spring-set type brakes release when voltage is applied to the brake coil.

The brakes are *not* designed for stopping rotation of the motor shaft. Servo drive inputs should be used to stop motor shaft rotation. The recommended method of stopping motor shaft rotation is to command the servo drive to decelerate the motor to 0 rpm, and engage the brake after the servo drive has decelerated the motor to 0 rpm.

If system main power fails, the brakes can withstand use as stopping brakes. However, use of the brakes as stopping brakes creates rotational mechanical backlash that is potentially damaging to the system, increases brake pad wear and reduces brake life. The brakes are *not* designed nor are they intended to be used as a safety device.

A separate power source is required to disengage the brake. This power source may be controlled by the servo motor controls, in addition to manual operator controls.

Encoder Data

The following section contains the N-Series encoder specifications.

Encoder Specifications

Motor Series	Line Count	Supply Voltage	Supply Current	Line Driver	Line Driver Output	Index Pulse
N-2300	1000 ^{1,2}	5V DC	175 mA Average	DS26C31TM	A, B, and I signals: Logic 1 = 2.5V DC minimum @ 20 mA DC source, Logic 0 = 0.5V DC maximum @ 20 mA DC sink	No feature on shaft for index pulse orientation.
N-3400 N-4200 N-5600	2000 ¹	5V DC	300 mA Average	26LS31	HALL signals: Logic 1 = 2.5V DC minimum @ 1mA DC source, Logic 0 = 0.5V DC maximum @ 5mA DC sink	When facing the motor, the key is oriented 90° ±10 clockwise (mechanical) from the connectors.

¹ Standard line count before quadrature.

² N-2300 encoder lacks Absolute Signal (ABS).

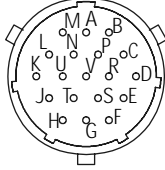
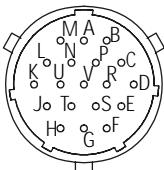
Note: Encoders are factory aligned. Do not adjust them outside the factory.

Connector Data

The following section contains the N-Series encoder, power, and brake connector pins and signals.

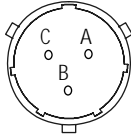
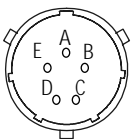
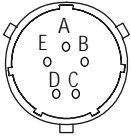
Encoder Connectors

NEMA 23-Series Encoder				NEMA 34, 42, & 56-Series Encoder			
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A	A+	L	Common	A	A+	L	Common
B	A-	M	Common	B	A-	M	Common
C	B+	N	Open	C	B+	N	Open
D	B-	P	Open	D	B-	P	Open
E	I+	R	Thermostat+	E	I+	R	Thermostat+
F	I-	S	Thermostat-	F	I-	S	Thermostat-
G	Open	T	Hall A	G	Open	T	Hall A
H	Open	U	Hall B	H	ABS	U	Hall B
J	5 VDC	V	Hall C	J	5 VDC	V	Hall C
K	5 VDC			K	5 VDC		



Power and Brake Connectors

NEMA 23-Series Power Connector		NEMA 34, 42 & 56-Series Power Connector		Brake Connector	
Pin	Signal	Pin	Signal	Pin	Signal
A	Phase U	A	Phase U	A	BR+
B	Phase V	B	Phase V	B	BR-
C	Phase W	C	Phase W	C	Open
D	Ground	D	Ground		
E	Open	E	Open		



Wire Sizing Recommendations

The following section contains the wire sizing recommendations for the N-Series power, encoder and brake connectors.

Connectors

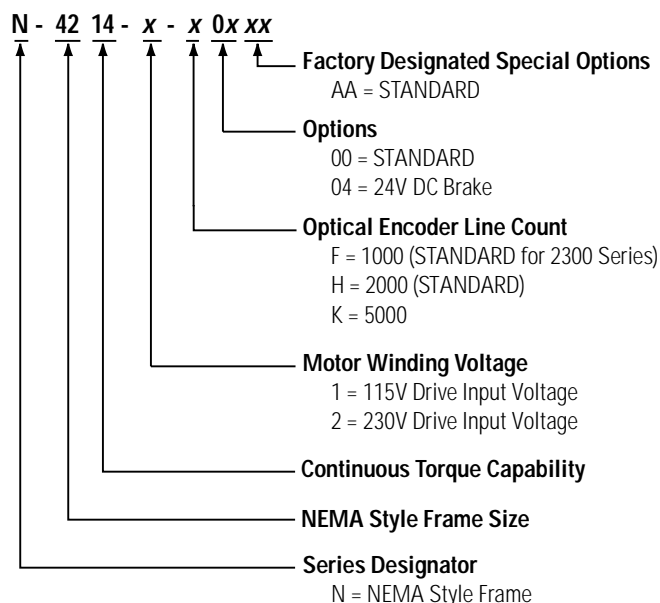
Motor	Power Connector	Motor	Encoder Connector	Motor	Brake Connector
	Wire ¹ mm ² (AWG)		Wire mm ² (AWG)		Wire mm ² (AWG)
N-Series	1.5 ² (16)	N-Series	0.0804 ² (28) 1.5 ² (16)	N-Series	0.82 ² (18)

¹ Sizes are recommended minimum values for 4 conductors (U, V, W and GND).

Note: Wiring should be twisted, and local regulations should always be observed.

N-Series Motor Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering table chart below to understand the configuration of your motor. For questions regarding product availability, contact your Allen-Bradley distributor.



Note: Optional configurations or encoder line counts have extended lead times and additional charges

Note: Options are not available in all sizes.

Note: 5000-line count encoder, motor top speed is limited to 3600 rpm due to frequency output limit of encoder. Check drive system configuration data for any additional restrictions imposed by drive input.

Y-Series Motors



Y-Series motors, available in either 115V or 230V windings, provide low inertias for fast accelerations. Typical applications include robotics, material handling, specialty machinery, medical and laboratory equipment, X-Y table, light packaging machines, office machines and postal sorting.

Each servo motor features:

- 115V and 230V windings.
- Popular metric mounting dimensions.
- Continuous torque from 0.17 to 2.5 N-m (1.5 to 22 lb-in.).
- Motor-mounted optical encoder with differential line driver data (2000-line) and commutation signal.
- Low-inertia rotor.
- High-energy neodymium magnets.
- Speeds up to 4500 RPM.
- Optional internally mounted spring set, magnetic release 24V DC holding brake.
- IP43 environmental rating.

Note: For drive compatibility, refer to the Motor Selection Chart in *Preface*.

General Specifications

The following section contains the Y-Series performance, mechanical, winding, and storage/operating specifications.

Ultra5000 and Ultra3000 Performance Specifications for Y-Series Motors^{1, 2}

Motor	Drives		Maximum speed rpm	Continuous stall torque ⁴ N-m (lb-in.)	Peak torque ⁵ N-m (lb-in.)
	2098-IPD-	2098-DSD- ³			
Y-1002-1 (115V) Y-1002-2 (230V)	005	005	4500	0.17 (1.5)	0.48 (4.3)
Y-1003-1 (115V) Y-1003-2 (230V)	010 005	010 005	4500 5000	0.35 (3.1)	0.97 (8.6)
Y-2006-1 (115V) Y-2006-2 (230V)	020 010	020 010	4500 5000	0.69 (6.1)	1.92 (17)
Y-2012-1 (115V) Y-2012-2 (230V)	020 010	020 010	3800 4500	1.4 (12)	3.8 (33.7)
Y-3023-2 (230V)	020	020	4500	2.5 (22.5)	7.1 (63)

¹ Ambient temperature is 0° C to 40° C (0° F to 104° F) for motors and 0° C to 50° C (0° F to 122° F) for drives.

² At drive input voltage of either 115V or 230V.

³ These specifications also apply to Ultra3000 controllers equipped with the indexing or SERCOS interface options.

⁴ At 125° C (257° F) winding temperature, in a 40° C (104° F) ambient, with motor mounted on aluminum heat sinks: motors 1002, 1003—0.125 in. x 6 in. x 6 in.; motors 2006, 2012—0.250 in. x 8 in. x 8 in.; motor 3023—0.25 in. x 10 in. x 10 in.

⁵ System limit.

Mechanical Specifications

Motor	Rotor moment of inertia kg-m ² (lb-in.-s ²)	Rotor moment of inertia (brake motors) kg-m ² (lb-in.-s ²)	Motor shipping weight kg (lb)	Motor net weight kg (lb)	Damping N-m/kRPM (lb-in./kRPM)	Friction torque N-m (lb-in.)
Y-1002-1 (115V) Y-1002-2 (230V)	0.0000031 (0.000027)	0.0000039 (0.000034)	0.9 (2.0)	0.5 (1.1)	0.002 (0.022)	0.005 (0.04)
Y-1003-1 (115V) Y-1003-2 (230V)	0.0000051 (0.000045)	0.0000059 (0.000052)	1.0 (2.3)	0.7 (1.5)	0.003 (0.03)	0.007 (0.06)
Y-2006-1 (115V) Y-2006-2 (230V)	0.000015 (0.00013)	0.000020 (0.00018)	1.7 (3.8)	1.3 (2.9)	0.009 (0.08)	0.022 (0.20)
Y-2012-1 (115V) Y-2012-2 (230V)	0.000026 (0.00023)	0.000032 (0.00028)	2.3 (5.1)	1.9 (4.1)	0.01 (0.10)	0.03 (0.29)
Y-3023-2 (230V)	0.000064 (0.00056)	0.000069 (0.00061)	3.9 (8.7)	3.5 (7.8)	0.021 (0.19)	0.072 (0.64)

Winding Specifications

Motor	Sine wave K_T torque constant at 25° C (77° F) ¹ N-m/A (lb-in./A)	K_E voltage constant ² V/kRPM	Winding resistance phase to phase at 25° C (77° F) Ohm	Winding inductance phase to phase mH	Thermal resistance ³ °C/Watt	Encoder Resolution P/R	Poles
Y-1002-1 (115V) Y-1002-2 (230V)	0.08 (0.73) 0.16 (1.4)	10 20	4.6 18.8	5.5 22.3	2.3	2000	8
Y-1003-1 (115V) Y-1003-2 (230V)	0.11 (1.0) 0.20 (1.8)	14 25	3.2 8.9	3.8 11.5	2.2		
Y-2006-1 (115V) Y-2006-2 (230V)	0.10 (0.95) 0.22 (1.9)	13 27	0.79 3.2	2.7 12	1.3		
Y-2012-1 (115V) Y-2012-2 (230V)	0.24 (2.1) 0.37 (3.3)	29 45	1.3 2.9	5.1 12.4	1.3		
Y-3023-2 (230V)	0.33 (2.9)	40	0.78	6	0.85		

¹ Peak value of per phase sine wave amps.

² Peak value of sinusoidal phase to phase volts.

³ At 125° C (257° F) winding temperature, in a 40° C (104° F) ambient, with motor mounted on aluminum heat sinks: motors 1002, 1003—0.125 in. x 6 in. x 6 in.; motors 2006, 2012—0.250 in. x 8 in. x 8 in.; motor 3023—0.25 in. x 10 in. x 10 in.

Storage and Operating Specifications

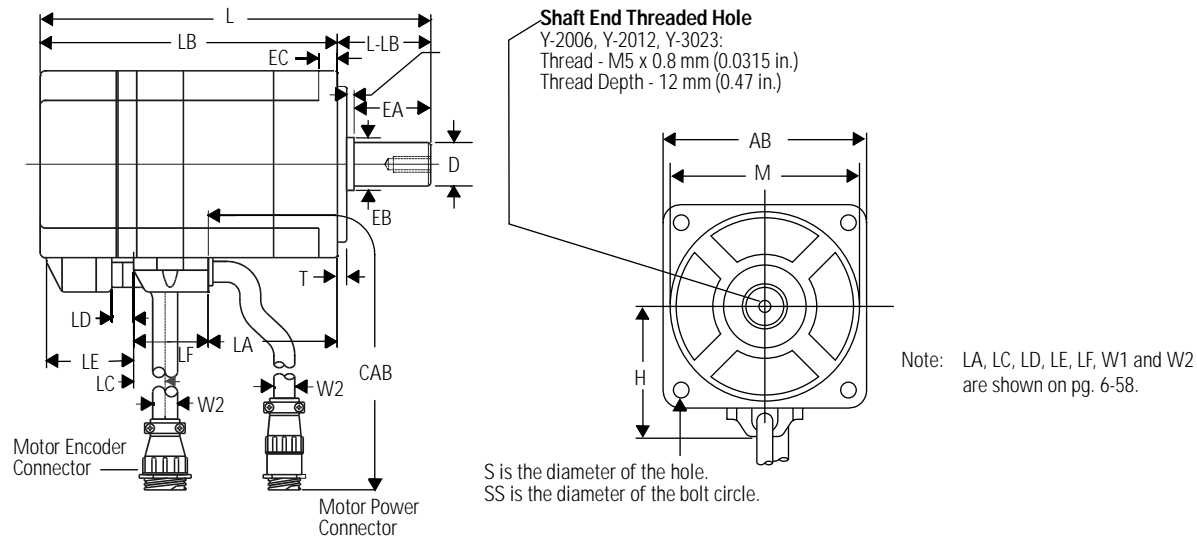
Specification	Description
Ambient Temperature	Operating: 0° to 40° C (32° to 104° F) Storage: -20° to 65° C (-4° to 149° F)
Relative Humidity	20% to 90% non-condensing
Vibration	2.5g peak, 30-2000 Hz
Shock	10g peak, 6 ms duration

Motors Dimensions

The following section contains the dimensions for Y-Series motors.

Figure 6.18

Y-Series Servo Motor Dimensions (Y-xxxx-x-H0xAA)



Motor Series	AB mm (in.)	CAB mm (in.)	D mm (in.)	EA mm (in.)	EB mm (in.)	EC mm (in.)	ED mm (in.)	H mm (in.)	L mm (in.)	L (Brake) mm (in.)	LB mm (in.)	L-LB mm (in.)	M mm (in.)	S mm (in.)	SS mm (in.)	T mm (in.)
Y-1002	40 (1.58) ³	1100 (43.34) ⁷	8 (0.31) ⁸	—	—	5 (0.20) ³	—	30 (1.18) ⁵	95 (3.74)	108.5 (4.27) ⁵	70 (2.75) ⁵	25 (0.98) ⁴	30 (1.18)	4.5 (0.18) ¹	46 (1.81) ¹	2.5 (0.10) ²
Y-1003	40 (1.58) ³	1100 (43.34) ⁷	8 (0.31) ⁸	—	—	5 (0.20) ³	—	30 (1.18) ⁵	113 (4.45)	126.5 (4.98) ⁵	88 (3.46) ⁵	25 (0.98) ⁴	30 (1.18)	4.5 (0.18) ¹	46 (1.81) ¹	2.5 (0.10) ²
Y-2006	60 (2.36) ³	1100 (43.34) ⁷	14 (0.55) ⁹	—	—	6 (0.24) ³	—	41 (1.61) ⁵	125.5 (4.94)	133.5 (5.3) ⁵	95.5 (3.76) ⁵	30 (1.18) ⁴	50 (1.97)	5.5 (0.22) ¹	70 (2.75) ¹	3 (0.12) ²
Y-2012	60 (2.36) ³	1100 (43.34) ⁷	14 (0.55) ⁹	—	—	6 (0.24) ³	—	41 (1.61) ⁵	153.5 (6.04)	161.5 (6.36) ⁵	123.5 (4.87) ⁵	30 (1.18) ⁴	50 (1.97)	5.5 (0.22) ¹	70 (2.75) ¹	3 (0.12) ²
Y-3023	80 (3.15) ³	1100 (43.34) ⁷	16 (0.63) ⁹	35 (1.38) ²	19.5 (0.77) ²	8 (0.31) ³	2.0 (0.08)	52 (2.05) ⁵	180 (7.09)	180.5 (7.11) ⁵	140 (5.57) ⁵	40 (1.57) ⁴	70 (2.75)	6.6 (0.26) ¹	90 (3.54) ¹	3 (0.12) ²

¹ Tolerance is ±0.2 mm (±0.00788 in.).

² Tolerance is ±0.3 mm (±0.01182 in.).

³ Tolerance is ±0.5 mm (±0.0197 in.).

⁴ Tolerance is ±0.8 mm (±0.03152 in.).

⁵ Tolerance is ±1.0 mm (±0.0394 in.).

⁶ Tolerance is ±2.0 mm (±0.0788 in.).

⁷ Tolerance is ±100 mm (±3.94 in.).

⁸ Tolerance is −0.009 mm (−0.0004 in.).

⁹ Tolerance is −0.011 mm (−0.0004 in.).

Supplemental Motors Dimensions

Motor Series	LA mm (in.)	LC mm (in.)	LC (Brake) mm (in.)	LD mm (in.)	LD (Brake) mm (in.)	LE mm (in.)	LE (Brake) mm (in.)	LF mm (in.)	W1 mm (in.)	W2 mm (in.)
Y-1002	23.5 (0.90) ²	17.5 (0.7) ^{1, 2}	56 (2.2) ^{1, 2}	–	–	–	–	21.5 (0.84) ⁵	6 (0.24) ⁵	8 (0.32) ⁵
Y-1003	41.5 (1.60) ²									
Y-2006		–	–	7 (0.28) ²	45 (1.77) ²	28 (1.1) ⁴	66 (2.6) ^{1, 4}	24 (0.95) ⁵		
Y-2012	69.5 (2.7) ²						68.5 (2.7) ^{1, 4}	30 (1.2) ⁵		
Y-3023	80.5 (3.2) ²									

¹ Measurement is to the center of the perpendicular motor encoder cable. Motor encoder cable exits perpendicular to the frame on Y-1002 and Y-1003 motors (not as shown).

² Tolerance is ± 2.0 mm (± 0.0788 in.).

³ Tolerance is ± 0.5 mm (± 0.0197 in.).

⁴ Tolerance is ± 2.5 mm (± 0.0985 in.).

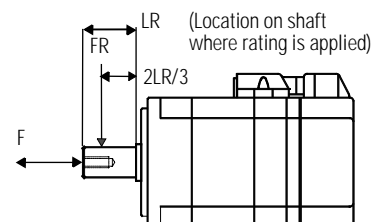
⁵ Tolerance is ± 1.0 mm (± 0.0394 in.).

Load Force Ratings

The following section contains the Y-Series shaft radial load force ratings and axial load force ratings.

Figure 6.19

Y-Series Motor Load Forces (Y-xxxx-x-H0xAA)



- With no radial load, the axial load rating is 100% of the radial load rating from the table below.
- With a radial and an axial load, the axial load rating is 44% of the radial load rating from the table below.

Motor Series	Shaft Radial Load (FR) ¹ kg (lb)	Axial Load (F) ¹ kg (lb)
Y-1002	10 (22.05)	3 (6.615)
Y-1003		
Y-2006	20 (44.1)	8 (17.64)
Y-2012	25 (55.125)	10 (22.05)
Y-3023	35 (77.175)	20 (44.1)

¹ The FR and F refer to loads applied as shown in the drawing above.

Brake Specifications and Application Guidelines

The following section contains the Y-Series brake motor specifications and application guidelines.

Specifications

Motor Series	Holding torque N-m (lb-in.)	Coil current at 24V DC Amps
Y-1002	(0.157) 1.39	0.26
Y-1003	(0.32) 2.83	
Y-2006	(0.637) 5.64	0.31
Y-2012	(1.274) 11.24	
Y-3023	(2.38) 21.06	0.37

Application Guidelines

The brakes offered as options on these servo motors are holding brakes designed to hold the motor shaft at 0 rpm up to the rated brake holding torque. The spring-set type brakes release when voltage is applied to the brake coil.

The brakes are *not* designed for stopping rotation of the motor shaft. Servo drive inputs should be used to stop motor shaft rotation. The recommended method of stopping motor shaft rotation is to command the servo drive to decelerate the motor to 0 rpm, and engage the brake after the servo drive has decelerated the motor to 0 rpm.

If system main power fails, the brakes can withstand use as stopping brakes. However, use of the brakes as stopping brakes creates rotational mechanical backlash that is potentially damaging to the system, increases brake pad wear and reduces brake life. The brakes are *not* designed nor are they intended to be used as a safety device.

A separate power source is required to disengage the brake. This power source may be controlled by the servo motor controls, in addition to manual operator controls.

Encoder Data

The following section contains the Y-Series encoder specifications.

Encoder Specifications

Specification	Description
Line Counts ¹	Data A+, A-, B+, B-: 2000 pulses/revolution Index I+, I-: 1 pulses/revolution Hall A+, A-, B+, B-, C+, C-: 2 pulses/revolution
Supply Voltage	4.75 to 5.25V DC
Supply Current	450 mA DC
Line Driver	AM26LS31 equivalent
Line Driver Output	Output: Logic 1 - Sourcing 2.5V DC @ 20 mA Output: Logic 0 - Sinking 0.5V DC @ 20 mA

¹ Standard line count before quadrature.

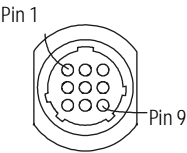
Note: Encoders are factory aligned. Do not adjust them outside the factory.

Connector Data

The following section contains pins and signals for the Y-Series power and encoder connectors.

Power Connector

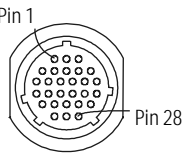
Pin	Signal	Pin	Signal
1	Phase U	6	–
2	Phase V	7	Brake+ ¹ (Option)
3	Phase W	8	–
4	–	9	Brake- ¹ (Option)
5	Ground		



¹ No connection for nonbrake motors.

Encoder Connector

Pin	Signal	Pin	Signal
1 - 8	–	17	Hall B+
9	A+	18	Hall B-
10	A-	19	Hall C+
11	B+	20	Hall C-
12	B-	21	–
13	I+	22	+5V DC
14	I-	23	COM
15	Hall A+	24	SHIELD
16	Hall A-	25 - 28	–



¹ COM (+5V DC) is not connected to the motor ground.

² SHIELD is connected to the motor case ground.

Wire Sizing Recommendations

The following section contains the wire sizing recommendations for the Y-Series power, brake and encoder connectors.

Connectors

Motor Series	Power and Brake Connectors	Motor Series	Encoder Connector
	Wire ¹ mm ² (AWG)		Wire mm ² (AWG)
Y-1002	1.5 ² (16)	Y-1002	0.0804 ² (28) 1.5 ² (16)
Y-1003		Y-1003	
Y-2006		Y-2006	
Y-2012		Y-2012	
Y-3023		Y-3023	

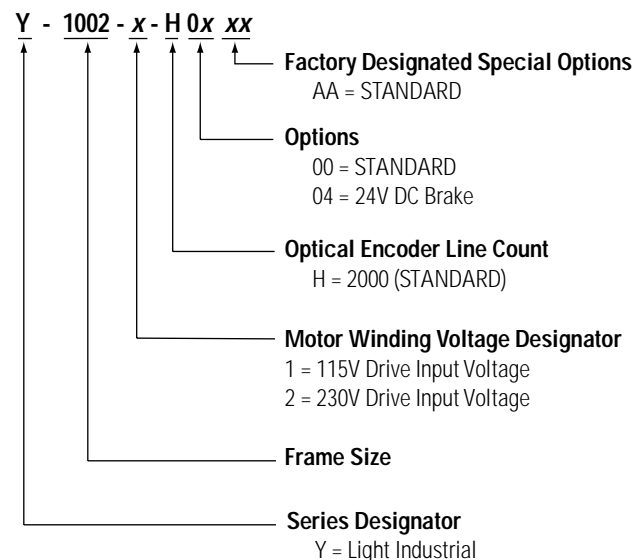
¹ Sizes are recommended minimum values for 4 conductors (U, V, W and GND).

Note: Sizes are recommended minimum values.

Note: Wiring should be twisted, and local regulations should always be observed.

Y-Series Motor Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering table chart below to understand the configuration of your motor. For questions regarding product availability, contact your Allen-Bradley distributor.



1326AB Series Motors



1326AB Torque Plus motors feature a specially engineered housing that reduces motor length and increases continuous torque ratings. These high performance, three-phase, brushless, AC, synchronous servo motors are designed by Allen-Bradley to meet the stringent requirements of high performance motion systems. This series of 460V, AC servo motors is intended to be used with the Allen-Bradley 1394 Motion Control System.

Each servo motor features:

- Special flux profile permanent magnets engineered by Allen-Bradley to increase servo response.
- A three-phase, sinusoidal-wound stator field for smooth operation at low speeds.
- TENV construction. IP65 is standard when used with the shaft oil seal kit (1326AB-MOD-SSV-xxx. IP67 (-L) option is available.
- An extruded aluminum housing for improved heat transfer.
- 100% continuous-rated output torque at stall (zero rpm).
- A UL Listed insulation system (file #E57948).
- The ability to be vertically mounted at any angle with the shaft up or down.
- A normally closed thermal switch in the motor winding (rated 115V AC/ 24V DC at 1A) that provides thermal overload indication.
- A precision balance of 0.0127 mm (0.0005 in.) total peak-to-peak displacement.
- A CEI/IEC 72-1 metric flange mount with metric shafts.
- A threaded hole on the face of the shaft for securing couplings.

Note: For drive compatibility, refer to the Motor Selection Chart in *Preface*.

Feedback Options

1326AB servo motors are available with either resolver (standard) or high-resolution encoder feedback devices. Resolver-based servo motors feature:

- A rugged, brushless resolver that provides accurate position feedback, eliminates the need for on-board electronics and can withstand harsh shock, high operating temperatures, and vibration.
- Resolver feedback generates (2048ppr) A quad B encoder output. High-resolution servo motors are available in single or multi-turn configurations that provide high-resolution encoder feedback for applications requiring precise tolerance.
- Single-turn (-S) configuration provides precise machine positions of two million counts per revolution.

- Multi-turn (-ML and -M2) configurations and the single-turn (-S2) configuration provide accurate absolute machine positions over multiple revolutions (no batteries needed) to eliminate machine re-homing on power-up. It provides one million counts of feedback per revolution and absolute positioning within 4,096 revolutions.
- Multi-turn and single-turn configurations feature on-board EEPROM memory for storing motor configuration information.

IMPORTANT

Multi-turn (-ML) high-resolution feedback can only be used with the 9/440 high-resolution feedback CNC.

IMPORTANT

Multi-turn and single turn (-M and -S) high-resolution feedback can only be used with the 1394 digital servo drive (1394C-SJTxx-D).

Motor Options

Options available for the 1326AB 460V AC Torque Plus Series include (the option code or catalog number is in parenthesis):

- Integral Spring-Set Holding Brakes with 24V DC coils (-K4, -K5, -K7).
- A Shaft Oil Seal kit, (1326AB-MOD-SSV-xx) for installing a Viton shaft oil seal on a motor in the field. Motor disassembly is not required. When the shaft oil seal is installed, the motor is dust tight, able to withstand pulsating water jets, and meet the IP65 requirements of the IEC 529 standard.

IMPORTANT

IP67 (-L) servo motors have a factory-installed shaft oil seal and do not require the Shaft Oil Kit option.

- Secondary Feedback Mounting Kits (1326AB-MOD-Mxx) for installing an Allen-Bradley Encoder (845H) in the field.

Note: Not available for high-resolution motors.

If you are using a 1326AB-Bxxx Servo Motor with a 1394 Servo System you do not need to mount a secondary encoder because the 1394 derives A Quad B feedback output (2048 ppr) from the motor feedback.

IMPORTANT

1326AB servo motors lose the IP65 or IP67 rating when an externally mounted encoder package is used.

- IP67 (-L) servo motors. The IP67 rating (IEC 529) provides environmental protection from the effects of temporary immersion in water.

IMPORTANT

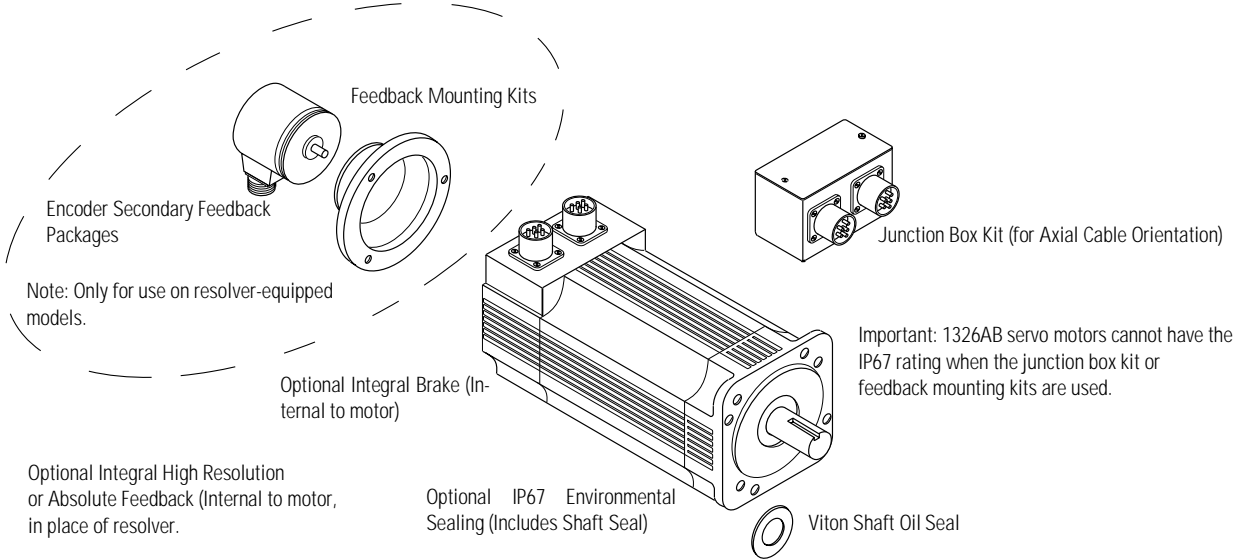
1326AB servo motors lose the IP67 rating when the externally-mounted encoder or the junction box kit options are used.

- A Junction Box Kit (1326AB-MOD-RJxxx) with axially-mounted connectors is available with either front or rear exit connections. Right-angle connector cables are also available. For more information, refer to Chapter 8, *Motion Control Accessories*. The junction box allows the motor connectors to be brought out axially (rather than radially) to the motor without further wiring.

IMPORTANT

1326AB servo motors lose the IP67 rating when the junction box kit option is used.

Figure 6.20
1326AB Torque Plus Servo Motor Configuration and Options (1326-AB-Bxxx21x-Kx)



General Specifications

The following section contains performance, mechanical, winding, constant, storage/operating, and mounting bolt specifications for the 1326AB servo motors.

Performance Specifications

Motor ¹ 1326AB-	Rated Speed rpm		Motor Rated Torque N·m (lb·in.)	Motor Rated Output kW	System Continuous Torque N·m (lb·in.)	System Peak Stall Torque N·m (lb·in.)	System Continuous Stall Current Amperes	System Peak Stall Current Amperes	1394 Axis Module
	460V	380V							
B410G	5000	4000	2.7 (24)	1.0	2.7 (24)	6.6 (58) ³	2.45	6.0	AM03
						8.1 (72)		7.32	AM04
									AM07
B410J	7250	6000	2.7 (24)	1.4	2.3 (21) ²	4.7 (42) ³	3.0	6.0	AM03
					2.7 (24)	7.0 (62) ³		9.0	AM04
						8.1 (72)		10.4	AM07

Performance Specifications, Continued

Motor ¹ 1326AB-	Rated Speed rpm		Motor Rated Torque N-m (lb-in.)	Motor Rated Output kW	System Continuous Torque N-m (lb-in.)	System Peak Stall Torque N-m (lb-in.)	System Continuous Stall Current Amperes	System Peak Stall Current Amperes	1394 Axis Module
	460V	380V							
B420E	3000	2500	5.0 (44)	1.1	5.0 (44)	10.6 (94) ³	2.84	6.0	AM03
						14.9 (132)		8.0	AM04
									AM07
B420H	6000	5000	5.1 (45)	2.2	2.8 (25) ²	5.6 (50) ³	3.0	6.0	AM03
					4.2 (37) ²	8.4 (74) ³	4.5	9.0	AM04
					5.1 (45)	14.0 (124) ³	5.46	15.0	AM07
B430E	3000	2500	6.6 (58)	1.4	5.1 (45) ²	10.1 (89) ³	3.0	6.0	AM03
					6.6 (58)	15.2 (135) ³	3.9	9.0	AM04
						19.7 (174)		11.6	AM07
B430G	5000	4000	6.4 (57)	2.3	5.2 (46) ²	10.3 (92) ³	4.5	9.0	AM04
					6.4 (57)	17.2 (153) ³	5.6	15.0	AM07
B515E	3000	2500	10.4 (92)	2.3	7.7 (68) ²	15.4 (136) ³	4.5	9.0	AM04
					10.4 (92)	25.6 (226) ³	6.1	15.0	AM07
						31.2 (276)		18.3	AM50 AM75
B515G	5000	4000	10.4 (92)	2.9	7.9 (70) ²	15.8 (140) ³	7.5	15	AM07
					10.4 (92)	31.2 (276)	9.5	28.5	AM50 AM75
B520E	3000	2500	13.0 (115)	2.9	8.8 (78) ²	17.7 (157) ³	4.5	9.0	AM04
					13.0 (115)	29.4 (260) ³	6.7	15.0	AM07
						39.0 (345)		20.1	AM50 AM75
B520F	3500	3000	13.1 (116)	2.9	11.2 (99) ²	22.4 (198) ³	7.5	15.0	AM07
					13.1 (116)	39.3 (348)	8.8	26.4	AM50 AM75
B530E	3000	2500	18.0 (160)	4.2	14.2 (126) ²	28.4 (251) ³	7.5	15.0	AM07
					18.0 (160)	54.2 (480)	9.5	28.5	AM50 AM75
B720E	3500	3000	30.9 (273)	6.8	30.9 (273)	58.5 (518) ³	17.5	33.2	AM50
						88.1 (780) ³		50.0	AM75

Performance Specifications, Continued

Motor ¹ 1326AB-	Rated Speed rpm		Motor Rated Torque N·m (lb-in.)	Motor Rated Output kW	System Continuous Torque N·m (lb-in.)	System Peak Stall Torque N·m (lb-in.)	System Continuous Stall Current Amperes	System Peak Stall Current Amperes	1394 Axis Module
	460V	380V							
B720F	5000	4100	31.8 (281.7)	11.7	31.8 (281.7)	38 (336) ³	27.5	33.2	AM50
						56 (495) ³		50	AM75
B730E	3350	2800	39.0 (345)	9.6	39.0 (345)	56.8 (502) ³	22.8	33.2	AM50
						85.4 (756) ³		50.0	AM75
B740C	2200	1800	53.0 (469)	8.7	53.0 (469)	84.2 (745) ³	20.9	33.2	AM50
						126.8 (1122) ³		50.0	AM75
B740E	3400	2800	50.0 (450)	12.7	50.0 (450)	52.7 (466) ³	32.0	33.2	AM50
						79.4 (702) ³		50.0	AM75

¹ All ratings are for 40° C (104° F) motor ambient, 110° C (212° F) case and 50° C (122° F) amplifier ambient. For extended ratings at lower ambients contact Rockwell Automation.

² Limited by axis module continuous current.

³ Limited by axis module peak current.

Mechanical Specifications

Motor 1326AB-	Rotor moment of inertia kg·m ² (lb-in.-s ²)	Motor net weight kg (lb)	Balance ¹ mm (in.)
B410G	0.000433 (0.00383)	10 (22)	0.0127 (0.0005)
B410J			
B420E	0.0008 (0.007)	12.7 (28)	
B420H			
B430E	0.001 (0.01)	16.8 (37)	
B430G			
B515E	0.0043 (0.038)	21.3 (47)	
B515G			
B520E	0.006 (0.05)	27.7 (61)	
B520F			
B530E	0.009 (0.08)	34.5 (76)	
B720E	0.015 (0.14)	46.3 (102)	
B720F	0.0173 (0.153)	62.6 (138)	
B730E			
B740C	0.0336 (0.297)	77.1 (170)	
B740E			

¹ To obtain vibration velocity in inches (mm)/second, use the following formula: $V_v = D_p \cdot p \times \text{rpm} / 27.01$

where: V_v = Vibration velocity in mm (in.)/second

D_{p-p} = Peak-peak displacement in mm (in.)

rpm = Motor speed

Winding Specifications

Motor 1326AB-	Sine wave K_T torque constant at 25° C (77° F) ¹ N-m/A (lb-in./A)	K_E voltage constant ² V/kRPM	Winding resistance phase to phase at 25° C (77° F) Ohm	Winding inductance phase to phase mH	Poles
B410G	1.33 (11.7)	80.2	15.1	68.3	4
B410J	0.873 (7.73)	52.8	6.1	28.2	
B420E	2.02 (17.9)	122.2	12.9	67.3	
B420H	1.01 (8.94)	61.1	3.23	16.9	
B430E	2.02 (17.9)	122	7	40.6	
B430G	1.35 (11.9)	81.6	3.32	18.1	
B515E	2.02 (17.9)	122	3.28	28.1	
B515G	1.24 (11)	75.1	1.25	10.4	
B520E	2.33 (20.66)	141	2.85	25.4	
B520F	1.74 (15.4)	105	1.76	14.2	
B530E	2.27 (20.1)	137	1.54	15.8	
B720E	2.12 (18.7)	126	0.66	10.4	
B720F	1.36 (12)	82.2	0.29	4.52	
B730E	2.21 (18.7)	128	0.4	6.42	
B740C	3.09 (27.4)	187	0.61	11.6	
B740E	2.05 (18.2)	124	0.25	4.56	

¹RMS value of per phase sine wave amps; 3 phase RMS current.

²RMS value of sinusoidal phase to phase volts.

Constant Specifications

Motor 1326AB-	Mechanical Time Constant at 25° C (77° F) ms	Electrical Time Constant at 25° C (77° F) ms	Thermal Time Constant minutes
B410G	11.1	4.52	23
B410J	10.4	4.62	
B420E	7.43	5.22	33
B420H	7.42	5.23	
B430E	5.88	5.8	38
B430G	6.23	5.45	
B515E	8.68	8.57	45
B515G	8.73	8.32	
B520E	7.39	8.91	56
B520F	8.23	8.07	
B530E	6.24	10.3	66
B720E	7.64	15.8	55

Constant Specifications, Continued

Motor 1326AB-	Mechanical Time Constant at 25° C (77° F) ms	Electrical Time Constant at 25° C (77° F) ms	Thermal Time Constant minutes
B720F	8.14	15.6	60
B730E	6.8	16.1	
B740C	6.43	19	
B740E	5.99	18.2	

Storage and Operating Specifications

Specification	Description
Maximum Ambient Temperature (without derating)	Operating: 0° to 40° C (32° to 104° F) Storage: -30° to 70° C (-25° to 158° F)
Relative Humidity	5% to 95% non-condensing
Insulation Class	B
Shock	10g peak, 6 ms duration
Vibration	2.5g peak, 3-2000Hz

¹ The thermostat is normally used as a switch for a 24V DC logic signal.

Thermostat Specifications

Specification	Description
Rated voltage	0 - 250V DC or 50/60 Hz AC ¹
Rated current	2.5A at power factor of 1.0 1.6A at power factor of 0.6
Maximum switching current	5A
Contact resistance	Less than 0.10 Ohms maximum
Contacts	Normally closed
Insulation dielectric	Mylar Nomex capable of withstanding 1500V AC RMS 50/60 Hz for 1 minute
Opening temperature ±5° C (±41° F)	140° C (284° F)

¹ The thermostat is normally used as a switch for a 24V DC logic signal.

Motor Mounting Bolt Specifications

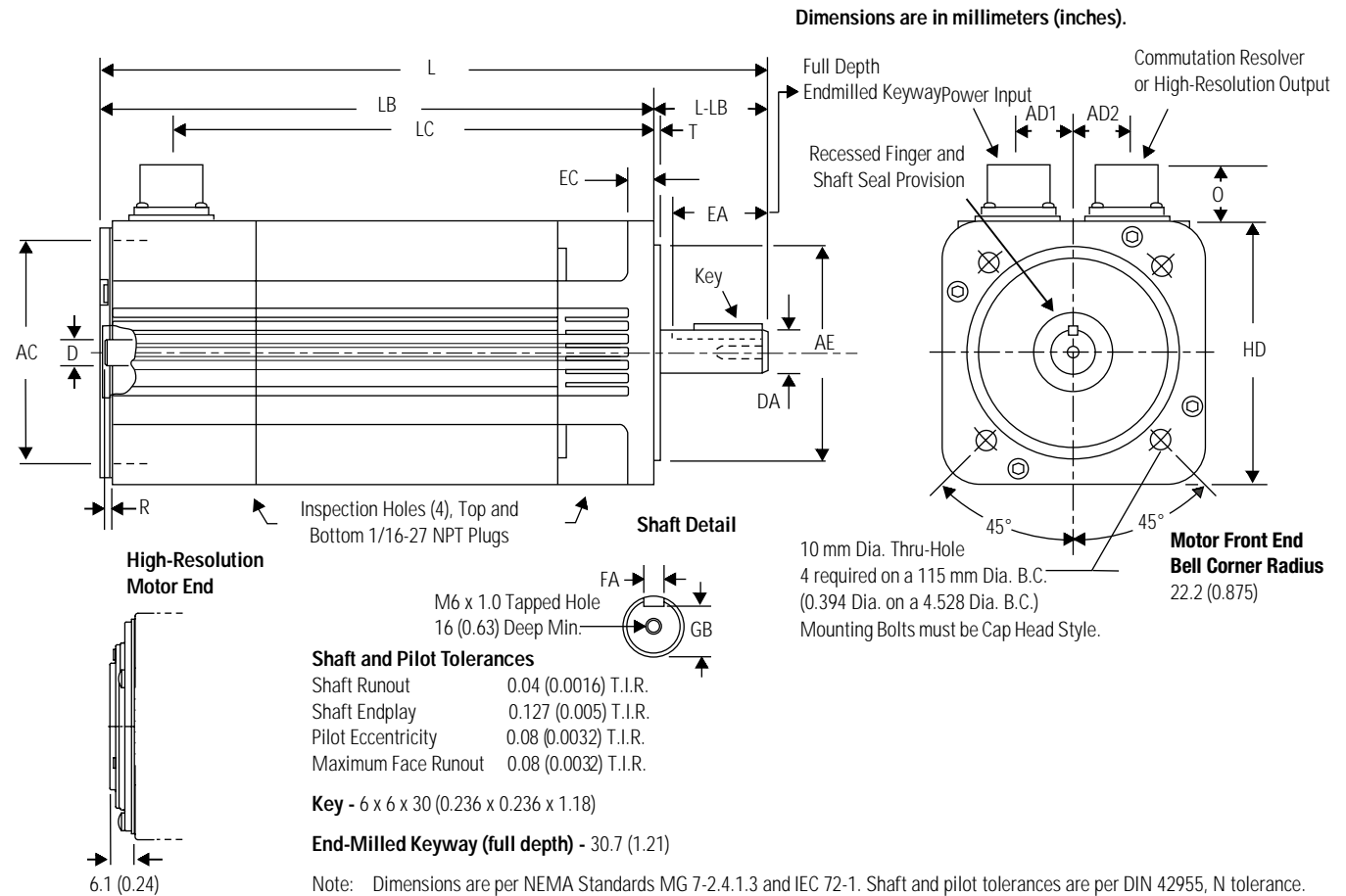
Motor Series 1326AB-	Bolt Size	Pitch mm (in.)	Flange Thickness mm (in.)	Screw Length mm (in.)	Torque ¹ N-m (lb.-ft.)
B4xxx	M8	1.25 (0.049)	11.2 (0.44)	25 (0.984)	37.94-47.42 (28-35)
B5xxx	M10	1.5 (0.059)	15 (0.591)	30 (1.18)	54.20-74.53 (40-55)
B7xxx	M12	1.75 (0.069)	20.6 (0.811)	40 (1.57)	108.4-135.5 (80-100)

¹ Torque values are typical. Actual values depend on fastener materials used.

Motors Dimensions

The following section contains the dimensions for 1326AB servo motors.

Figure 6.21
1326AB-B4 Torque Plus Servo Motor Dimensions (Resolver and High Resolution Feedback) (1326-AB-B4xx21x-Kx)



Motor 1326AB-	AC mm (in.)	AD1 mm (in.)	AD2 mm (in.)	AE mm (in.)	D mm (in.)	DA mm (in.)	EA mm (in.)	EC mm (in.)	FA mm (in.)	GB mm (in.)	HD mm (in.)	L (Resolver) ^{1,2} mm (in.)
B410x-21xx	92.07 (3.628)	25.4 (1)	25.4 (1)	95 (3.74)	9.51 (0.375)	19 (0.75)	30.7 (1.21)	11.2 (0.44)	6 (0.24)	15.36 (0.6)	126.5 (4.98)	275.6 (10.85)
B420x-21xx												333 (13.11)
B430x-21xx												402.8 (15.86)

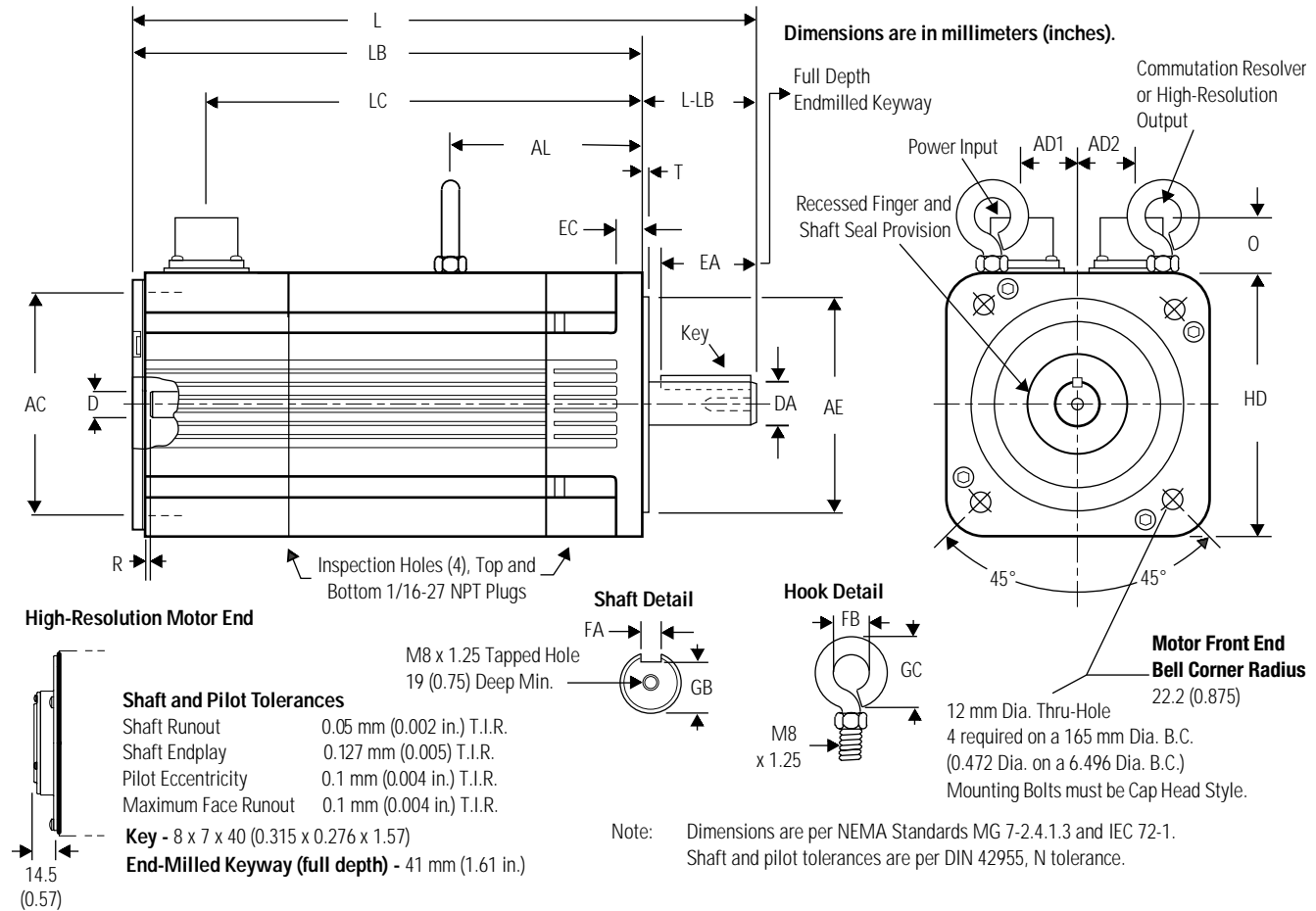
Motor 1326AB-	L (High Resolution) ^{1,2} mm (in.)	LB (Resolver) ^{1,2} mm (in.)	LB (High Resolution) ^{1,2} mm (in.)	LC ^{1,2} (Resolver and High Resolution) mm (in.)	L-LB mm (in.)	O mm (in.)	R mm (in.)	T mm (in.)
B410x-21xx	281.7 (11.09)	235.7 (9.28)	241.8 (9.52)	201.7 (7.94)	40 (1.57)	24.4 (0.96)	2.8 (0.11)	3 (0.118)
B420x-21xx	338.8 (13.34)	292.9 (11.53)	299 (11.77)	258.8 (10.19)				
B430x-21xx	408.7 (16.09)	362.7 (14.28)	368.8 (14.52)	328.7 (12.94)				

¹ If ordering a 1326AB-B4xxx-21-K4 with optional 24V DC 8.1 N-m (72 lb-in.) brake, add 45 mm (1.75 in.).

² If ordering a 1326AB-B4xxx-21-xK4L with optional 24V DC 8.1 N-m (72 lb-in.) brake (IP67 rated), add 45 mm (1.75 in.).

³ These dimensions apply to resolver and high resolution feedback motors.

Figure 6.22
1326AB-B5 Torque Plus Servo Motor Dimensions (Resolver and High Resolution Feedback)



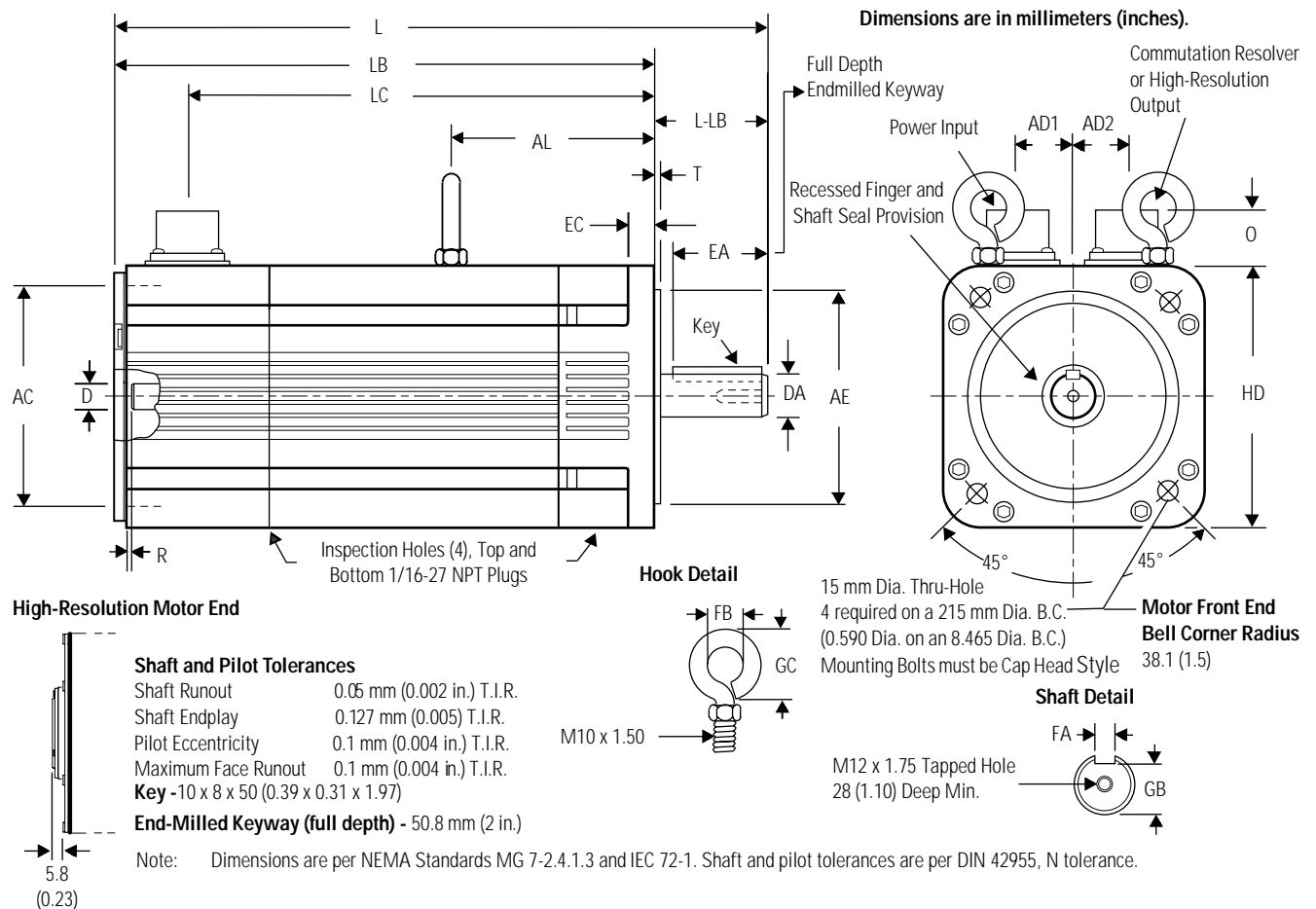
Motor 1326AB-	AC mm (in.)	AD1 mm (in.)	AD2 mm (in.)	AE mm (in.)	AL ^{1,2} (Resolver and High Resolution) mm (in.)	D mm (in.)	DA mm (in.)	EA mm (in.)	EC mm (in.)	FA mm (in.)	FB mm (in.)	GB mm (in.)	GC mm (in.)	HD mm (in.)
B515x-21xx	326.6 (12.86)	25.4 (1)	25.4 (1)	130 (5.118)	187 (7.362)	9.51 (0.374)	24 (0.945)	41.7 (1.61)	15 (0.59)	8.04 (0.316)	16.03 (0.625)	19.86 (0.782)	32.1 (1.25)	163.6 (6.44)
B520x-21xx														
B530x-21xx														

Motor 1326AB-	L (Resolver) ^{1,2} mm (in.)	L (High Resolution) ^{1,2} mm (in.)	LB (Resolver) ^{1,2} mm (in.)	LB (High Resolution) ^{1,2} mm (in.)	LC ^{1,2} (Resolver and High Resolution) mm (in.)	L-LB mm (in.)	O mm (in.)	R mm (in.)	T mm (in.)
B515x-21xx	326.6 (12.86)	341.1 (13.43)	276.6 (10.89)	291.1 (11.46)	244.1 (9.61)	50 (1.97)	25.4 (1)	2 (0.79)	3.5 (0.138)
B520x-21xx	364.7 (14.36)	379.2 (14.93)	314.7 (12.39)	329.2 (12.96)	282.2 (11.11)				
B530x-21xx	447.3 (17.61)	461.8 (18.18)	397.3 (15.64)	411.7 (16.21)	364.7 (14.36)				

¹ If ordering a 1326AB-B5xxx-21-K5 with optional 24V DC, 13.6 N-m (120 lb-in.) brake, add 76.2 mm (3.0 in.) to LC, LB and L (38.1 mm (1.5 in.) to AL).

² If ordering a 1326AB-B5xxx-21-xK5L with optional 24V DC, 13.6 N-m (120 lb-in.) brake (IP67 rated), add 76.2 mm (3.0 in.) to LC, LB and L (38.1 mm (1.5 in.) to AL).

Figure 6.23

1326AB-B7 Torque Plus Servo Motor Dimensions (Resolver and High Resolution Feedback) (1326-AB-B7xx21x-Kx)

Motor 1326AB-	AC mm (in.)	AD1 mm (in.)	AD2 mm (in.)	AE mm (in.)	AL ^{1,2} (Resolver and High Resolution) mm (in.)	D mm (in.)	DA mm (in.)	EA mm (in.)	EC mm (in.)	FA mm (in.)	FB mm (in.)	GB mm (in.)	GC mm (in.)	HD mm (in.)
B720x-21xx					164.3 (6.468)									
B730x-21xx	173.6 (6.835)	28.7 (1.13)	28.7 (1.13)	190 (7.0867)	208.7 (8.218)	9.51 (0.374)	32.019 (1.2603)	50.8 (2)	20.6 (0.81)	10.04 (0.395)	19.23 (0.75)	26.87 (1.058)	39.49 (1.54)	207.5 (8.17)
B740x-21xx					253.2 (9.968)									

Motor 1326AB-	L (Resolver) ^{1,2} mm (in.)	L (High Resolution) ^{1,2} mm (in.)	LB (Resolver) ^{1,2} mm (in.)	LB (High Resolution) ^{1,2} mm (in.)	LC ^{1,2} (Resolver and High Resolution) mm (in.)	L-LB mm (in.)	O mm (in.)	R mm (in.)	T mm (in.)
B720x-21xx	426 (16.77)	431.8 (17)	366 (14.41)	371.9 (14.64)	324.6 (12.78)				
B730x-21xx	514.9 (20.27)	520.7 (20.5)	454.9 (17.91)	460.8 (18.14)	413.5 (16.28)	60 (2.36)	26.9 (1.06)	3.96 (0.156)	4 (0.157)
B740x-21xx	603.8 (23.77)	609.6 (24)	543.8 (21.41)	549.7 (21.64)	502.4 (19.78)				

¹ If ordering a 1326AB-B7xxx-21-K7 with an optional 24V DC, 45.1 N-m (400 lb-in.) brake, add 76.2 mm (3.0 in.) to LC, LB and L (38.1 mm (1.5) to AL).

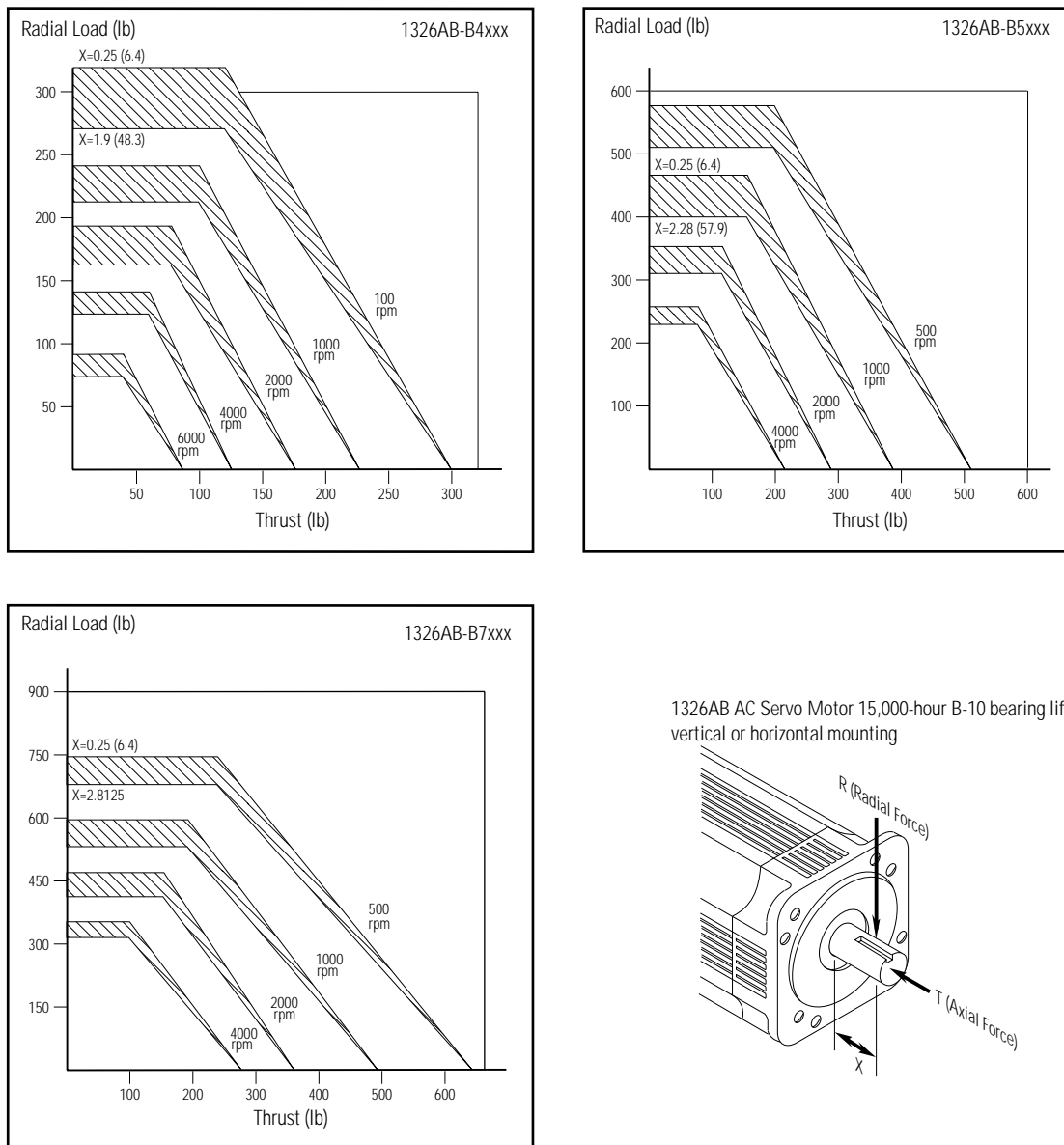
² If ordering a 1326AB-B7xxx-21-xK7L with an optional 24V DC, 45.1 N-m (400 lb-in.) brake (IP67 rated), add 76.2 mm (3.0 in.) to LC, LB and L (38.1 mm (1.5) to AL).

Load Force Ratings

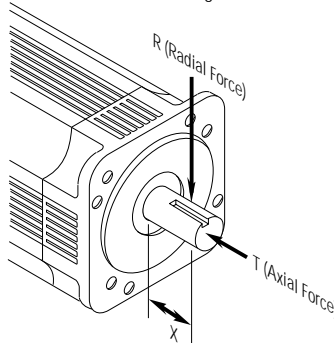
The following section contains the 1326AB servo motor output shaft radial load and thrust load ratings.

Figure 6.24

1326AB Servo Motor Output Shaft Radial Load vs. Thrust Load (1326-AB-Bxxx21x-Kx)



1326AB AC Servo Motor 15,000-hour B-10 bearing life - vertical or horizontal mounting



Integral Holding Brake

The following section contains a description of and specifications for a 1326AB servo motor integral holding brake.

The disc-type brake is spring-set when power is removed. It is designed to hold a load at rest and provide limited braking torque for emergency stopping. The brake is not intended to be used as a positioning brake (brake backlash is 0.8 arc-minutes maximum) or meant to be continuously cycled to assist in stopping a load.

ATTENTION



To avoid personal injury or property damage, ensure the brake is not energized/de-energized more than 90 times an hour when used as a parking brake. The parking brake is only meant to hold a stationary load and not intended to stop motor movement unless a power interruption occurs. For more information, refer to the table below.

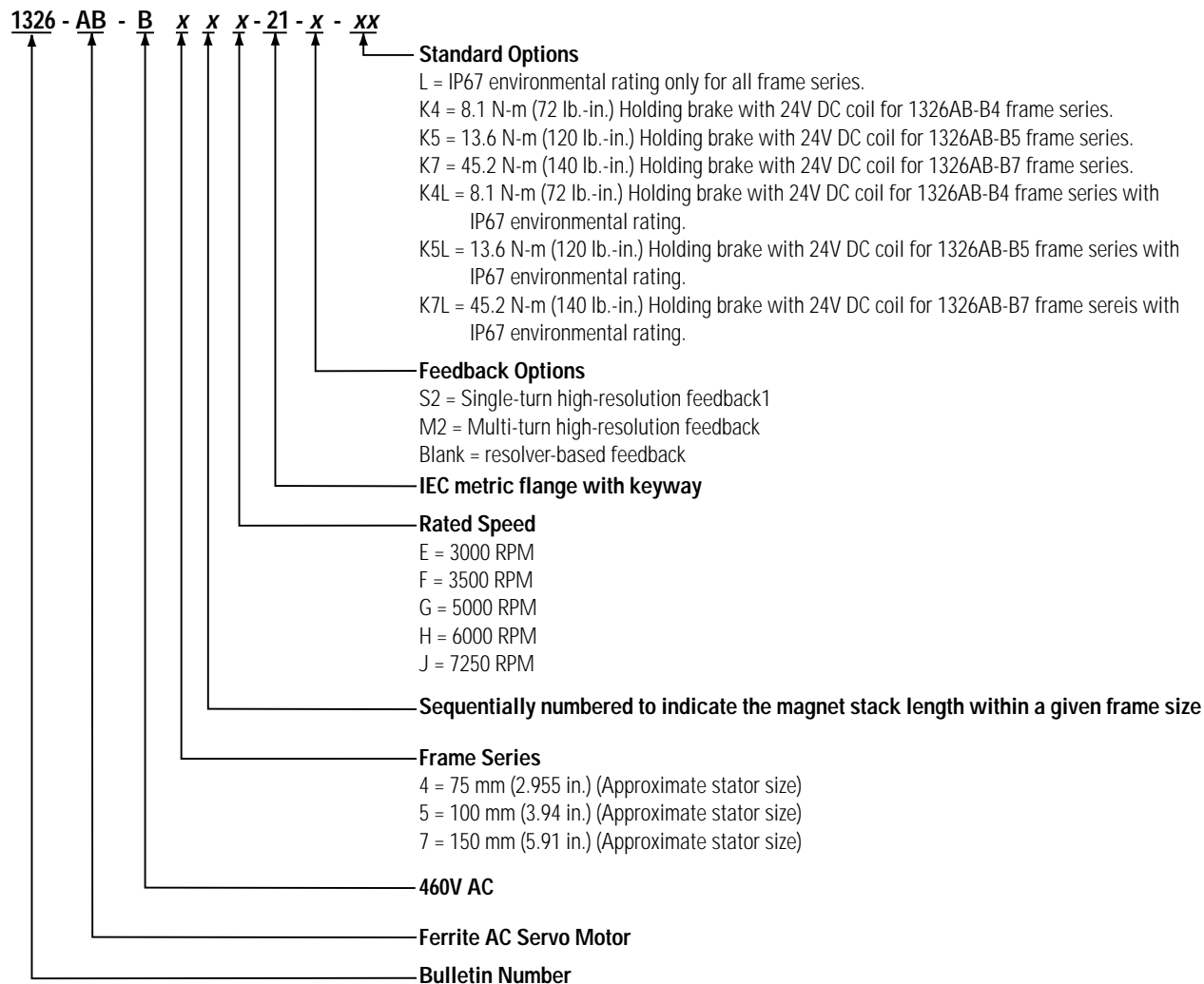
Specifications

Brake Option-	Holding Torque N-m (lb-in.)	Current Draw when Energized (24V DC input) Amps	Brake Response Time Pickup/Dropout (ms)	Weight Added to Motor Weight kg (lb)	Inertia Added to Motor Inertia kg-cm-s ¹ (lb-in.-s ²)	Cold Resistance (ohms)
K4	8.1 (72)	0.88A	120/20	1.36 (3)	0.001 (0.001)	28
K5	13.6 (120)	1.2A	150/25	4.08 (9)	0.0031 (0.0027)	21
K7	45.1 (400)	1.2A	120/30	5.90 (13)	0.0053 (0.0046)	21

Note: To handle +1 Amp, an additional relay must be added.

1326AB Series Motor Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your motor. For questions regarding product availability, contact your Allen-Bradley distributor.



¹ High resolution encoder option is only available with IP67 environmental rating.

1326AS Series Motors



The 1326AS Series rare earth servo motors feature neodymium-iron-boron permanent magnet rotors that provide low inertias, high accelerations and high peak torques. These compact, environmentally-rugged, brushless, 460V servo motors are intended to be used with the Allen-Bradley 1394 Motion Control System.

Each 1326AS Series servo motor features:

- An economical, compact design that can function in harsh environments.
- Neodymium-iron-boron magnet rotors that provide a high torque-to-inertia rating for faster light machinery acceleration.
- A three-phase, sinusoidally wound stator field for smooth operation at slow speeds.
- TENV construction.
- IP65 environmental rating.
- An extruded aluminum housing for improved heat transfer.
- UL Listed.
- A CEI/IEC 72-1: 1991 metric flange mount with metric shafts.
- A normally closed thermal switch in the motor winding (maximum current rating of 2.5A at 250V AC) for thermal overload indication.
- A rugged, 2-pole brushless resolver that provides accurate position feedback, eliminates the need for on-board electronics and can withstand harsh shock, high operating temperatures and vibration. Resolver feedback generates 1024 ppr (4096 counts/rev) A Quad B encoder output.
- IP65-rated, quick release (bayonet release) connectors for easy installation and maintenance.
- The ability to be vertically mounted at any angle with the shaft up or down.
- Precision balance of 0.0127 mm (0.0005 in.) total peak-to-peak displacement.

Note: For drive compatibility, refer to the Motor Selection Chart in *Preface*.

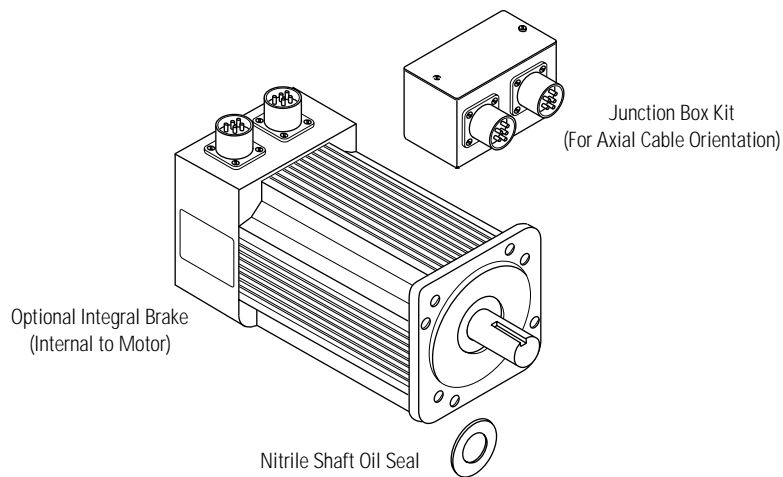
Motor Options

Options available for the 1326AS Series include:

- Integral spring-set holding brakes with 24V DC coils (-K3, -K4, -K6, and -K8).
- Shaft Oil Seal Kits for installing a Nitrile shaft seal in the field. Motor disassembly is not required. When the shaft seal is installed, the motor is dust tight, able to withstand pulsating water jets and meets the IP65 requirements of the IEC 529 standard.
- A Junction Box Kit (1326AS-RJxx) that can be installed in the field and which allows the existing motor connectors to be mounted axially (rather than radially) without further wiring is available with either front or rear exit connections.
- Right-angle connector cables (1326-xxx-RA-xxx, -RAL-xxx, -RB-xxx, and -RBL-xxx).

Figure 6.25

1326AS Servo Motor Options (1326AS-Bxxx-21-Kx)



General Specifications

The following section contains 1326AS servo motor performance, mechanical, winding, constants, storage and operating, and mounting bolt specifications.

Performance Specifications

Motor ¹ 1326AS-	Rated Speed rpm		Motor Rated Torque N-m (lb-in.)	Motor Rated Output kW	System Continuous Torque N-m (lb-in.)	System Peak Stall Torque N-m (lb-in.)	System Continuous Stall Current Amps	System Peak Stall Current Amps	1394 Axis Module
	460V	380V							
B310H	6200	5120	0.7 (6.1)	0.3	0.7 (6.1)	2.1 (18)	0.8	2.4	AM03
B330H	6500	5370	2.0 (18.0)	0.9	2.1 (18)	5.6 (50)	2.1	6.0	AM03
									AM04
B420G	5250	4340	3.2 (28.0)	1.2	3.2 (28)	7.3 (65) ³	2.6	6.0 ³	AM03
						9.6 (84)		7.8	AM04
									AM07
B440G	5250	4340	6.4 (56.0)	2.0	5.3 (47) ²	10.5 (93) ³	4.5 ²	9.0 ³	AM04
					6.4 (56)	17.6 (156)	5.4	15.0	AM07
						19.0 (168)		16.2	AM50
B460F	4300	3550	9.0 (80.0)	2.8	6.6 (58) ²	13.1 (116) ³	4.5 ²	9.0 ³	AM04
					9.0 (80)	21.9 (194)	6.2	15.0	AM07
						27.1 (240)		18.6	AM50
B630F	4500	3720	10.7 (95.0)	2.4	10.3 (91) ²	20.6 (182) ³	7.5 ²	15.0 ³	AM07
					10.7 (95)	25.4 (225)	7.8	18.5	AM50
B660E	3000	2480	21.5 (190)	3.4	13.7 (121) ²	27.3 (242) ³	7.5 ²	15.0 ³	AM07
					21.5 (190)	54.2 (480)	11.8	29.8	AM50
						54.2 (480)		29.8	AM75
B690E	3000	2480	36.4 (322)	5.0	36.4 (322)	63.6 (563) ³	19.0	33.2 ³	AM50
						79.1 (700)		41.3	AM75
B840E	3000	2480	37.6 (333)	4.7	37.6 (333)	59.0 (522) ³	21.2	33.2 ³	AM50
						70.0 (620)		39.5	AM75
B860C	2000	1650	49.3 (436)	6.0	49.3 (436)	93.0 (823) ³	17.6	33.2 ³	AM50
						124.0 (1100)		44.4	AM75

¹ All ratings are for 40° C (104° F) motor ambient, 100° C (212° F) case and 50° C (122° F) amplifier ambient. For extended ratings at lower ambient temperatures, contact Rockwell Automation.

² Limited by the axis module continuous current.

³ Limited by axis module peak current.

Mechanical Specifications

Motor 1326AS-	Rotor moment of inertia kg-m ² (lb-in.-s ²)	Motor net weight kg (lb)	Balance ¹ mm (in.)
B310H	0.000045 (0.0004)	2.8 (6.2)	0.0127 (0.0005)
B330H	0.00009 (0.0008)	4.3 (9.4)	
B420G	0.0003 (0.0027)	8.1 (17.86)	
B440G	0.0005 (0.0046)	11.7 (25.79)	
B460F	0.00075 (0.0066)	13.8 (30.4)	
B630F	0.0014 (0.012)	18.3 (40.4)	0.0178 (0.0007)
B660E	0.0025 (0.022)	26.9 (59.4)	
B690E	0.0036 (0.032)	34.8 (76.8)	
B840E	0.0063 (0.056)	46.7 (103)	
B860C	0.0094 (0.083)	56.1 (123.6)	

¹ To obtain vibration velocity in inches (mm)/second, use the following formula: $V_v = D_{p-p} \times \text{rpm} / 27.01$

where: V_v = Vibration velocity in mm (in.)/second

D_{p-p} = Peak-peak displacement in mm (in.)

rpm = Motor speed

Winding Specifications

Motor 1326AS-	Sine wave K_T torque constant at 25° C (77° F) ¹ N-m/A (lb-in./A)	K_E voltage constant ² V/kRPM	Winding resistance phase to phase at 25° C (77° F) Ohm	Winding inductance phase to phase mH	Poles
B310H	1.04 (9.2)	63	110	100	6
B330H			10.2	24	
B420G	1.25 (11.1)	76	6.9	27	
B440G			2.5	10	
B460F	1.58 (14)	96	2.2	12	
B630F			1.1	9.5	8
B660E	2.09 (18.5)	127	0.76	8.6	
B690E	2.16 (19.1)	131	0.56	5.8	
B840E	1.94 (17.2)	118	0.34	7.1	
B860C	3.1 (27.4)	188	0.52	12	

¹ Peak value of per phase sine wave amps.

² Peak value of sinusoidal phase to phase volts.

Mechanical, Electrical and Thermal Constants

Motor 1326AS-	Mechanical Time Constant at 40° C (104° F) ms	Electrical Time Constant at 40° C (104° F) ms	Thermal Time Constant minutes
B310H	3.3	1.4	11
B330H	1.3	2.4	21
B420G	2	3.9	18
B440G	1.3	4	35
B460F	0.98	5.5	41
B630F	0.89	8.7	50
B660E	0.65	11.3	60
B690E	0.65	10.4	90
B840E	0.85	20.9	74
B860C	0.76	23.1	80

Storage and Operating Specifications

Specification	Description
Maximum Ambient Temperature (without derating)	Operating: 0° to 40° C (32° to 104° F) Storage: -30° to 70° C (-25° to 158° F)
Relative Humidity	5% to 95% non-condensing
Insulation Class	B
Shock	20g peak, 6 ms duration
Vibration	2.5g, 30-2000 Hz

¹ The thermostat is normally used as a switch for a 24V DC logic signal.

Thermostat Specifications

Specification	Description
Rated voltage	460V AC
Rated current	2.5A at 250V AC
Maximum switching current	5A
Contacts	Normally closed
Opening temperature $\pm 5^{\circ}$ C ($\pm 9^{\circ}$ F)	140° C (284° F)

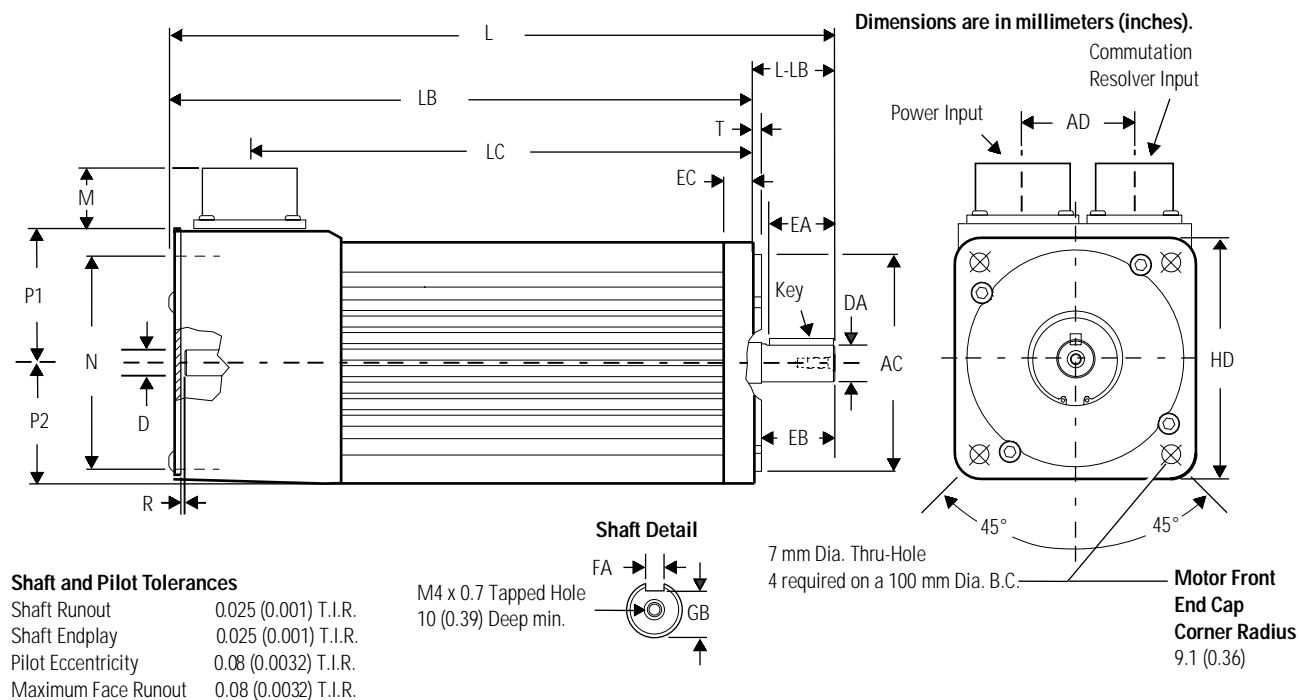
Motor Mounting Bolt Specifications

Motor Series 1326AS-	Bolt Size	Pitch mm (in.)	Flange Thickness mm (in.)	Screw Length mm (in.)	Torque N-m (lb-in.)
B3xxx	M6	1 (0.039)	10.9 (0.429)	20 (0.787)	20.16-24.19 (180-216)
B4xxx	M8	1.25 (0.049)	11.2 (0.44)	25 (0.984)	37.63-47.04 (336-420)
B6xxx	M12	1.75 (0.068)	21 (0.826)	40 (1.57)	107.52-134.4 (960-1,200)
B8xxx	M12	1.75 (0.068)	22.4 (0.881)	40 (1.57)	107.52-134.4 (960-1,200)

Motors Dimensions

The following section provides dimensions for the 1326AS Series servo motors.

Figure 6.26
1326AS-B3 Servo Motor Dimensions



Motor 1326AS-	AC mm (in.)	AD mm (in.)	D mm (in.)	DA mm (in.)	EA mm (in.)	EB ¹ mm (in.)	EC mm (in.)	FA mm (in.)	GB mm (in.)	HD mm (in.)
B310x-21	80 (3.15)	41 (1.61)	9.512 (0.37)	14 (0.551)	20 (0.787)	27 (1.063)	10.9 (0.429)	5 (0.197)	11 (0.431)	89(3.5)
B330x-21										

Motor 1326AS-	L ² mm (in.)	LB ² mm (in.)	LC ² mm (in.)	L-LB ³ mm (in.)	M mm (in.)	N mm (in.)	P1 mm (in.)	P2 mm (in.)	R mm (in.)	T ⁴ mm (in.)
B310x-21	195 (7.68)	165 (6.50)	135 (5.32)	30(1.181)	23 (0.91)	76.2 (3)	50 (1.97)	43 (1.69)	1.53 (0.06)	3 (0.118)
B330x-21	246 (9.68)	216 (8.50)	186 (7.32)							

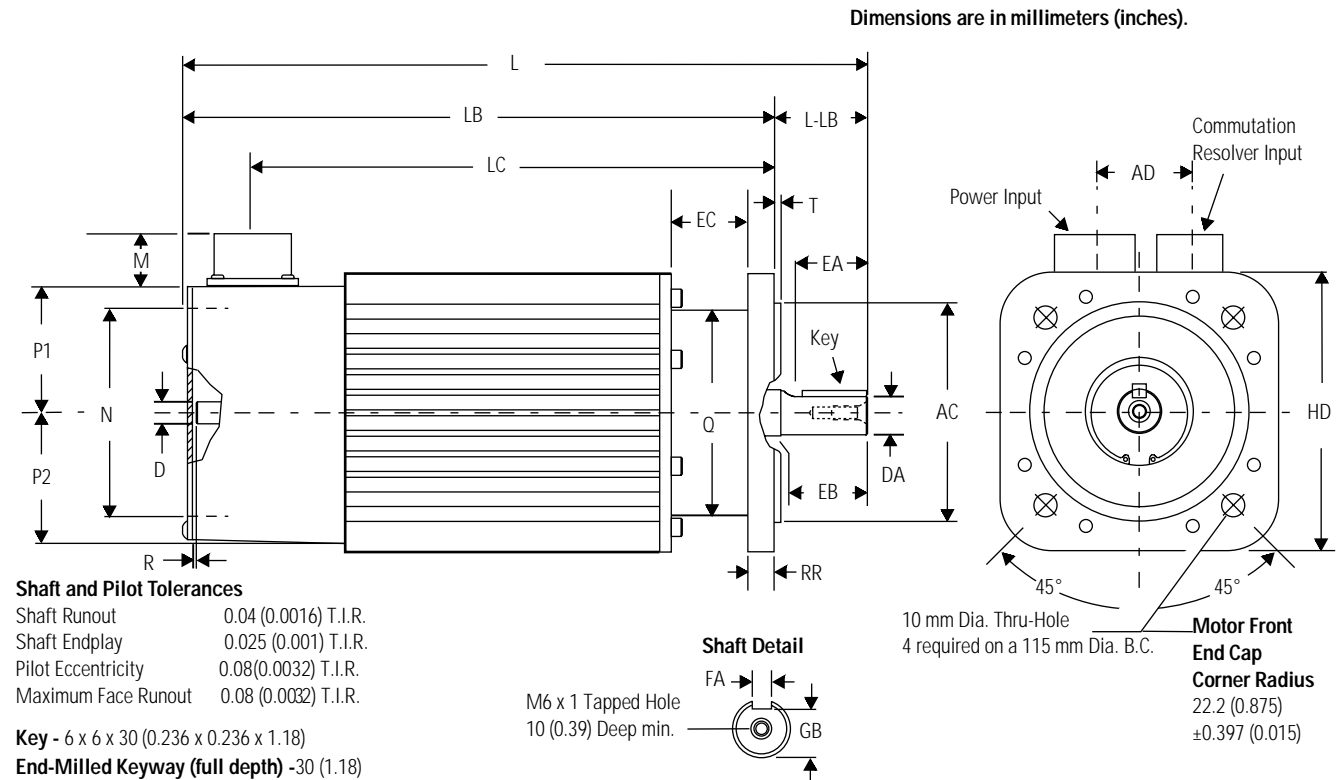
¹ Tolerance is ± 0.3 mm (0.12 in.)

² With an optional 24V DC 2.26 N-m (20 lb-in.) brake, add 39 mm (1.54 in.).

³ Tolerance is ± 0.5 mm (0.197 in.).

⁴ Tolerance is ± 0.2 mm (0.0078 in.).

Figure 6.27
1326AS-B4 Servo Motor Dimensions (1326AS-B4xx-21-Kx)



Motor 1326AS-	AC mm (in.)	AD mm (in.)	D mm (in.)	DA mm (in.)	EA mm (in.)	EB ^{1,2} mm (in.)	EC mm (in.)	FA mm (in.)	GB mm (in.)	HD mm (in.)	L ¹ mm (in.)
B420x-21	95 (3.74)	41 (1.61)	9.512 (0.375)	19 (0.7477)	30 (1.181)	37 (1.46)	33.1 (1.311)	6 (0.236)	15.45 (0.608)	121 (4.76)	278 (10.95)
B440x-21											329 (12.95)
B460x-21											380 (14.95)

Motor 1326AS-	LB ¹ mm (in.)	LC ¹ mm (in.)	L-LB ³ mm (in.)	M mm (in.)	N mm (in.)	P1 mm (in.)	P2 mm (in.)	Q mm (in.)	R mm (in.)	RR mm (in.)	T ⁴ mm (in.)
B420x-21	238 (9.38)	208 (8.19)	40 (1.575)	23 (0.91)	92.075 (3.625)	52 (2.05)	56 (2.2)	89 (3.504)	1.53 (0.06)	11.2 (0.441)	3 (0.118)
B440x-21	289 (11.38)	259 (10.19)									
B460x-21	340 (13.38)	310 (12.19)									

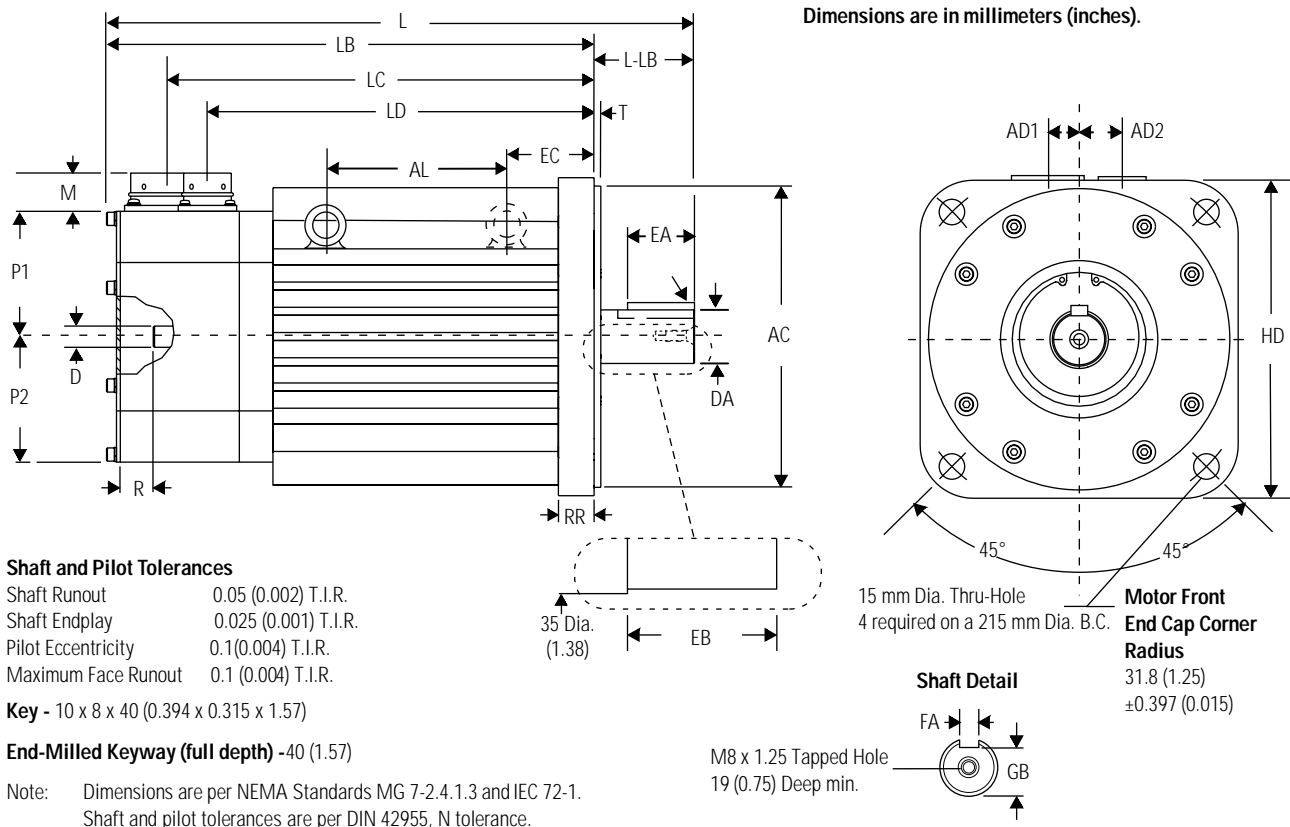
¹ With an optional 24V DC 10.2 N-m (90 lb-in.) brake, add 46 mm (1.81 in.).

² Tolerance is ±0.3 mm (0.12 in.).

³ Tolerance is ±0.5 mm (0.197 in.).

⁴ Tolerance is ±0.2 mm (0.0079 in.).

Figure 6.28
1326AS-B6 Servo Motor Dimensions (1326AS-B6xx-21-Kx)



Motor 1326AS-	AC mm (in.)	AD1 mm (in.)	AD2 mm (in.)	AL ¹ mm (in.)	D mm (in.)	DA mm (in.)	EA mm (in.)	EB ^{1,2} mm (in.)	EC mm (in.)	FA mm (in.)	GB mm (in.)	HD mm (in.)
B630x-21				69 (2.71)								
B660x-21	180 (7.08)	18 (0.71)	26 (1.02)	145 (5.71)	12.685 (0.4993)	32.009 (1.26)	40 (1.57)	56 (2.2)	72.13 (2.84)	9.98 (0.393)	26.9 (1.059)	190 (7.48)
B690x-21				221 (8.71)								

Motor 1326AS-	L ¹ mm (in.)	LB ¹ mm (in.)	LC ¹ mm (in.)	LD ¹ mm (in.)	L-LB ³ mm (in.)	M mm (in.)	P1 mm (in.)	P2 mm (in.)	R mm (in.)	RR mm (in.)	T ⁴ mm (in.)
B630x-21	351 (13.81)	291 (11.45)	255 (10.03)	231 (9.09)							
B660x-21	427 (16.81)	367 (14.45)	331 (13.03)	307 (12.09)	60 (2.36)	23 (0.91)	75 (2.95)	75 (2.95)	19.75 (0.775)	21 (0.83)	4 (0.157)
B690x-21	503 (19.81)	443 (17.45)	407 (16.03)	383 (15.09)							

¹ With an optional 24V DC 36.7 N-m (325 lb-in.) brake, add 54 mm (2.13 in.).

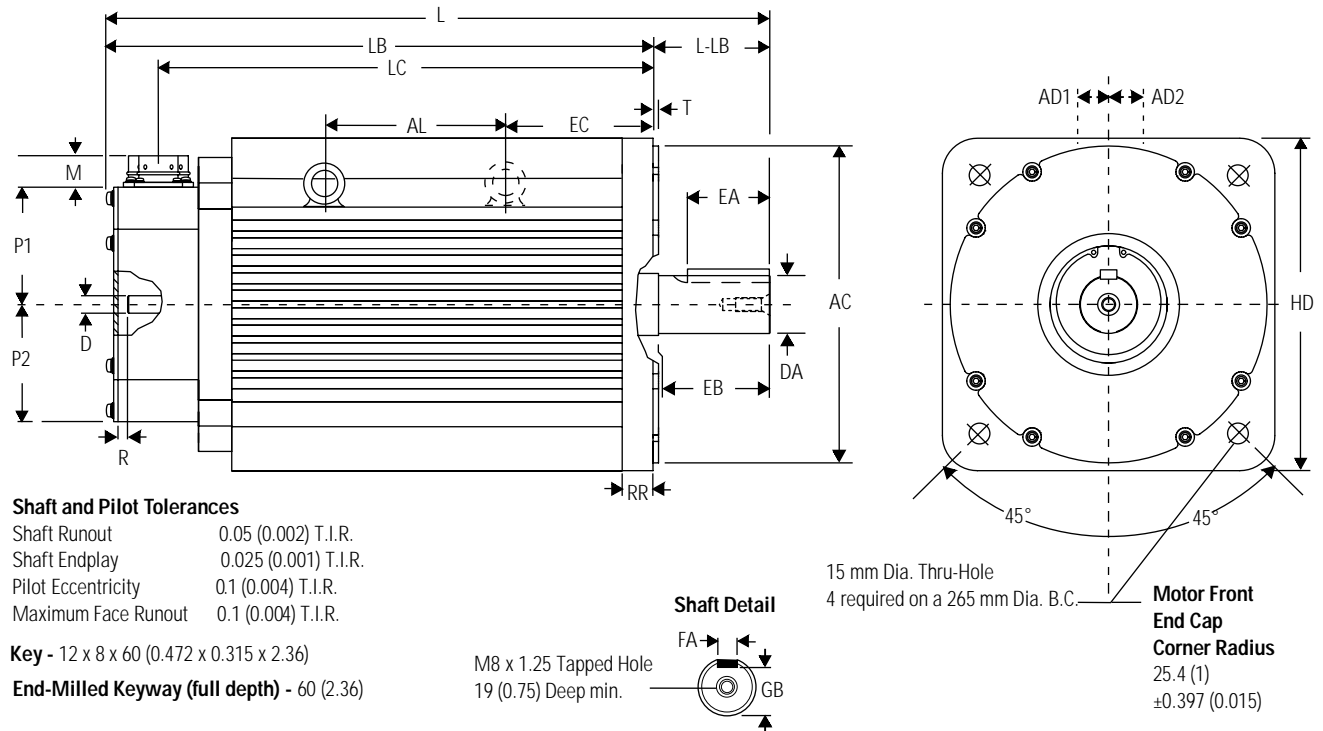
² Tolerance is ±0.3 mm (0.12 in.).

³ Tolerance is ±0.5 mm (0.197 in.).

⁴ Tolerance is ±0.2 mm (0.0079 in.).

Figure 6.29
1326AS-B8 Servo Motor Dimensions (1326AS-B8xx-21-Kx)

Dimensions are in millimeters (inches).



Note: Dimensions are per NEMA Standards MG 7-2.4.1.3 and IEC 72-1. Shaft and pilot tolerances are per DIN 42955, N tolerance.

Motor 1326AS-	AC mm (in.)	AD1 mm (in.)	AD2 mm (in.)	AL ¹ mm (in.)	D mm (in.)	DA mm (in.)	EA mm (in.)	EB ² mm (in.)	EC mm (in.)	FA mm (in.)	GB mm (in.)	HD mm (in.)
B840x-21	229.978 (9.054)	25 (0.98)	33 (1.3)	131 (5.15)	0.4993 (12.684)	41.992 (1.654)	60 (2.36)	81 (3.19)	73.15 (2.88)	11.98 (0.472)	36.9 (1.453)	241 (9.49)
B860x-21				235 (9.25)								

Motor 1326AS-	L ¹ mm (in.)	LB ¹ mm (in.)	LC ¹ mm (in.)	L-LB ³ mm (in.)	M mm (in.)	P1 mm (in.)	P2 mm (in.)	R mm (in.)	RR mm (in.)	T ⁴ mm (in.)
B840x-21	431 (16.97)	346 (13.63)	308 (12.13)	85 (3.35)	23 (0.91)	85 (3.35)	85 (3.35)	7 (0.27)	22.4 (0.882)	4 (0.157)
B860x-21	482 (18.97)	397 (15.63)	359 (14.13)							

¹ With an optional 24V DC 36.7 N-m (325 lb-in.) brake, add 54 mm (2.13 in.).

² Tolerance is ±0.3 mm (0.12 in.).

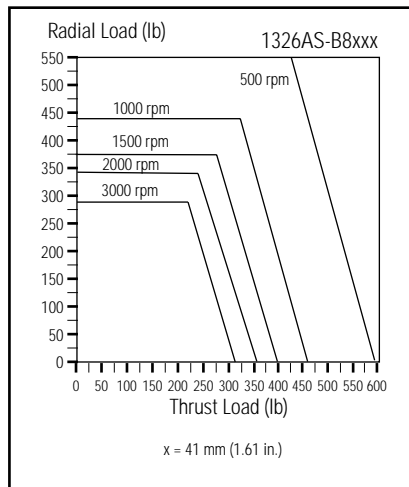
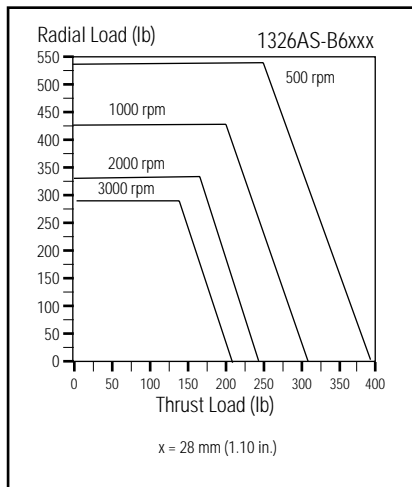
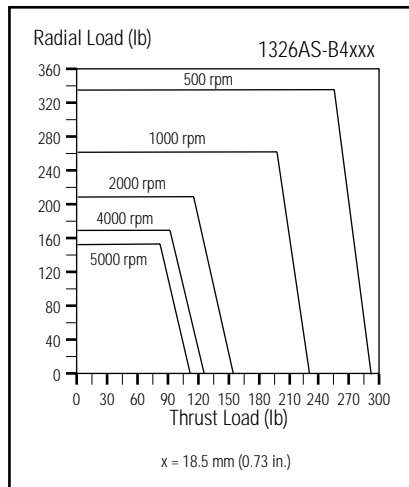
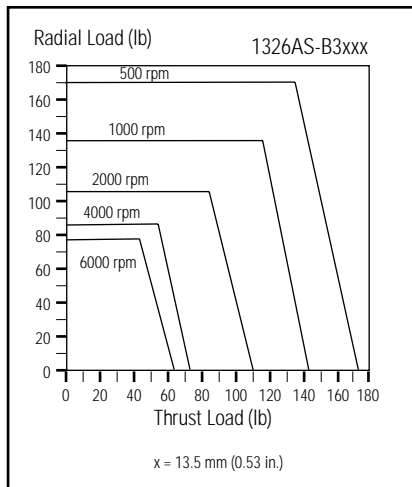
³ Tolerance is ±0.5 mm (0.197 in.).

⁴ Tolerance is ±0.2 mm (0.0079 in.).

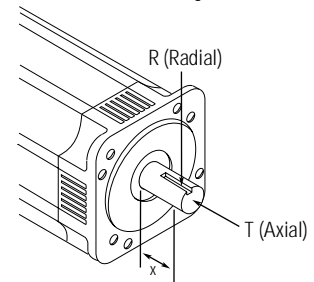
Load Force Ratings

The following section contains the 1326AS servo motor output shaft radial and thrust loads.

Figure 6.30
1326AS Servo Motor Output Shaft Radial Load vs. Thrust Load (1326AS-Bxxx-21-Kx)



1326AS Servo Motor 15,000-hour B10 bearing life—vertical or horizontal mounting.



Integral Holding Brake

The following section contains a description of and specifications for a 1326AS servo motor integral holding brake.

The disc-type brake is spring-set upon removal of power. It is designed to hold a load at rest and provide limited braking torque for emergency stopping. The brake is not intended to be used as a positioning brake or continuously cycled to assist in stopping a load. The brake must not be energized/de-energized more than 90 times an hour when used as a parking brake. A parking brake is only meant to hold a stationary load and is not intended to stop motor movement unless a power interruption occurs.

Specifications

Brake Option-	Holding Torque N-m (lb-in.)	Current draw When Energized (24V DC input)	Brake Response Time (ms) Pickup/Dropout	Weight Added to Motor Weight kg (lb)	Inertia Added to Motor Inertia kg-m ² (lb-in.-s ²)	Cold Resistance (Ohms)		Mechanical Backlash Degrees, minutes
						@ 25° C (77° F)	@ 40° C (104° F)	
K3	2.26 (20)	0.50A DC	38/10	0.8 (1.8)	0.000008 (0.00007)	48	63	1,30
K4	10.2 (90)	0.69A DC	44/13	2.1 (4.6)	0.00008 (0.0007)	35	45	0,44
K6	36.7 (325)	1.22A DC	114/11	6.3 (14)	0.00035 (0.0031)	19	25	0,18
K8	50.8 (450)	2.0A DC	200/12	15 (33)	0.0020 (0.018)	12	15	1,18

Note: To handle +1 Amps, an additional relay must be added.

1326AS Series Servo Motor Catalog Number

Note: Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your motor. For questions regarding product availability, contact your Allen-Bradley distributor

1326-AS-B 3 x x-21-xx

Standard Options

K3 = 2.26 N-m (20 lb.-in.) Holding brake with 24V DC coil for 1326AS-B3 frame series.

K4 = 10.2 N-m (90 lb.-in.) Holding brake with 24V DC coil for 1326AS-B4 frame series.

K6 = 36.7 N-m (325 lb.-in.) Holding brake with 24V DC coil for 1326AS-B6 frame series.

K8 = 50.9 N-m (450 lb.-in.) Holding brake with 24V DC coil for 1326AS-B8 frame series.

xxxxx = Special design options (factory assigned)

IEC metric flange with keyway

Rated Speed

C = 2000

E = 3000

F = 4300

G = 5250

H = 6200

Sequentially numbered to indicate the magnet stack length within a given frame size.

Frame Series

3 = 75 mm (2.955 in.) (Approximate stator size)

4 = 100 mm (3.94 in.) (Approximate stator size)

6 = 150 mm (5.91 in.) (Approximate stator size)

8 = 200 mm (7.88 in.) (Approximate stator size)

460V AC

Rare Earth AC Servo Motor

Bulletin Number

General Motor Performance Definitions

The following section contains a list of general motor performance definitions.

Rated Speed - The operating speed of the drive and motor combination at which approximately 70% of continuous rated torque (T_o) can be developed. This point is defined with the motor at 25° C (77° F).

Rated Operation Area - The boundary of the torque-speed curve where the motor and controller combination may operate on a servo basis without exceeding the RMS rating of either.

Intermittent Operation Area - The boundary of the torque-speed curve where the motor and controller combination may operate in acceleration/deceleration mode without exceeding peak rating of either, provided that the duty cycle RMS continuous torque limit is not exceeded.

$$\text{RMSTorque} = \sqrt{\frac{(T_{pa}^2)(t_1) + (T_{ss}^2)(t_2) + (T_{pd}^2)(t_3) + (T_r^2)(t_4)}{t_1 + t_2 + t_3 + t_4}}$$

Continuous Current - The rated current of a motor with windings at a rated temperature and an ambient temperature of 40° C (104° F).

Peak Current - The amount of current that can be applied to the motor without causing damage to the motor.

Mechanical Time Constant - The time required for the motor to reach 63% of its final speed when a step voltage is applied.

Electrical Time Constant - The time required for the motor to reach 63% of its rated current.

Max. Ambient Temperature - The maximum environmental temperature in which the motor can be operated at rated loads without exceeding its insulation-type temperature rise limits.

Insulation Class - The designation of the operating temperature limits for motor insulation materials.

Thermal Time Constant - The time required for the motor windings to reach 63% of continuous temperature rise with constant watts loss.

Torque Constant - The amount of torque developed for one ampere of motor current at the stated motor temperature.

Voltage Constant - The value of the generated voltage at a specified speed when the rotor is moved mechanically in the magnetic field.

Terminal Resistance - The winding resistance.

Inductance - The winding inductance measured by a step input of zero impedance voltage applied to the locked rotor.

Rotor Polar Moment of Inertia - The moment of inertia about the axis of rotation.

Motor Weight - The weight of the complete motor (including brake, if supplied) less the weight of options.

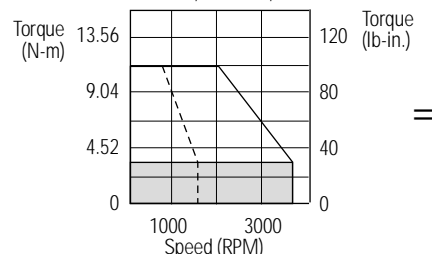
Balance - The compensation of rotor weight distribution to reduce vibrational resonance. Motors are factory balanced under running speeds.

System Combinations

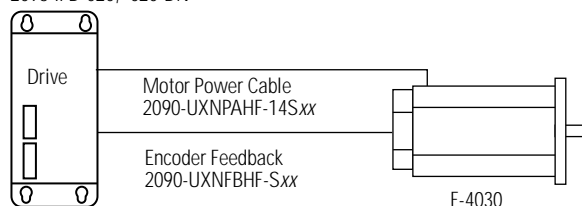
This chapter provides the Ultra3000, Ultra5000, and 1394 drive-motor combinations. Each combination includes the torque/speed reference table, motor power cable, and feedback cable. Refer to the chapter *Motors* for a list of general motor performance definitions.

Ultra3000 and Ultra5000 Drives with F-Series Motors

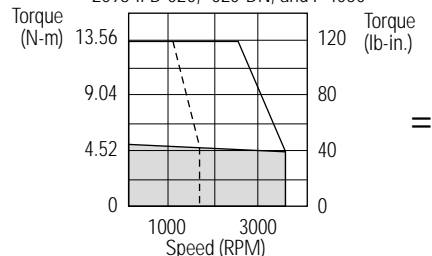
2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE,
2098-IPD-020, -020-DN, and F-4030



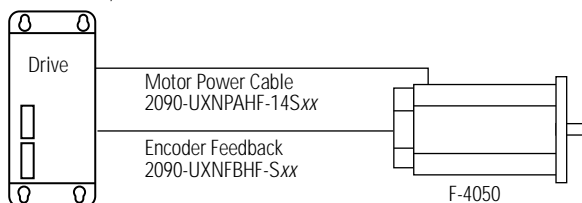
2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE
2098-IPD-020, -020-DN



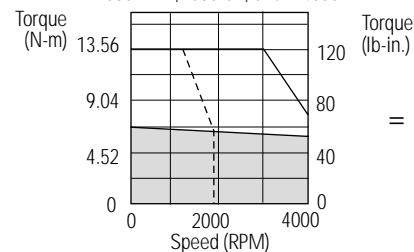
2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE,
2098-IPD-020, -020-DN, and F-4050



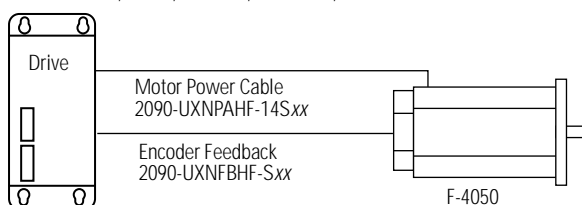
2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE
2098-IPD-020, -020-DN



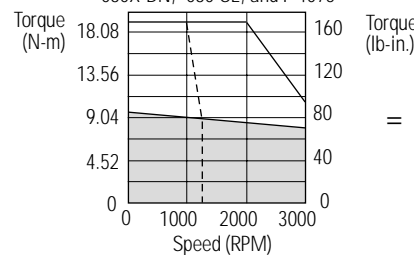
2098-DSD-030, -030X, -030-DN,
-030X-DN, -030-SE, and F-4050



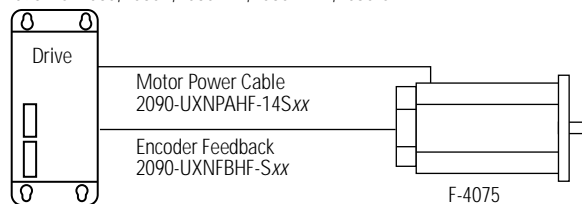
2098-DSD-030, -030X, -030-DN, -030X-DN, -030-SE



2098-DSD-030, -030X, -030-DN,
-030X-DN, -030-SE, and F-4075



2098-DSD-030, -030X, -030-DN, -030X-DN, -030-SE






System torque-speed characteristics
Drive module input voltage = 230V AC RMS

Ambient Temperature

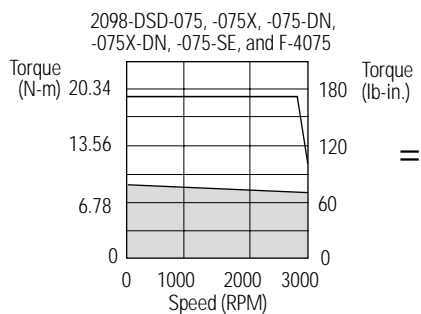
Motors: 0 to 40° C (32 to 104° F)

Drives: 0 to 50° C (32 to 122° F)

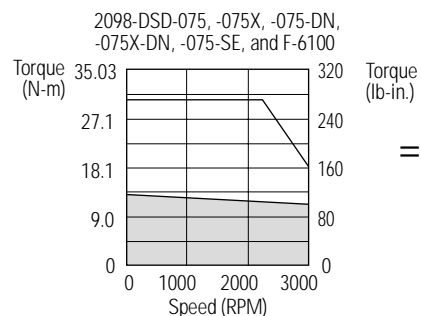
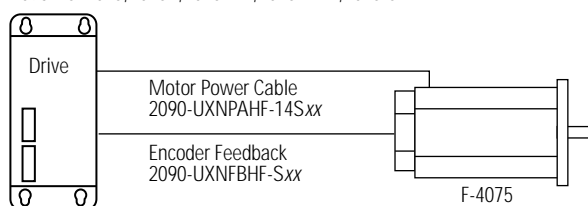
-  = Intermittent operating region
-  = Continuous operating region
-  = Drive operation with 115V AC RMS input voltage

Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

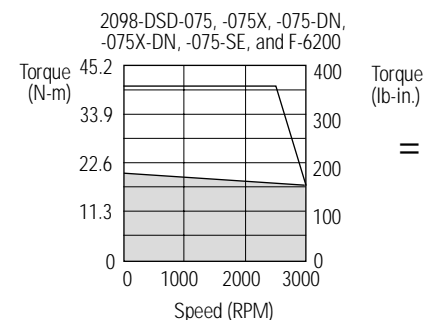
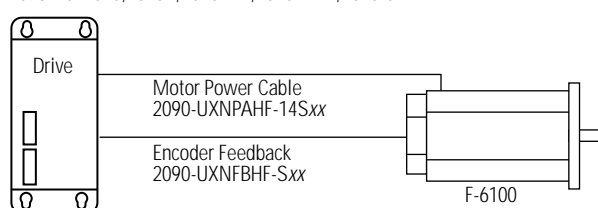
Ultra3000 and Ultra5000 Drives with F-Series Motors, Continued



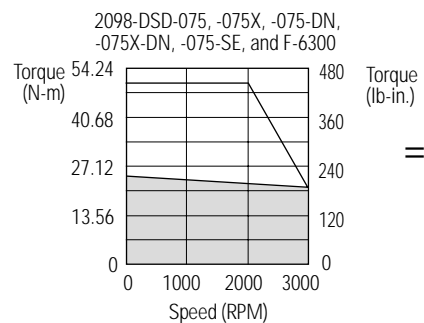
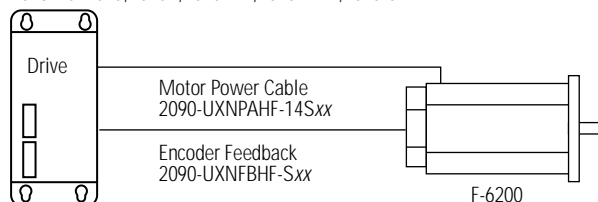
2098-DSD-075, -075X, -075-DN, -075X-DN, -075-SE



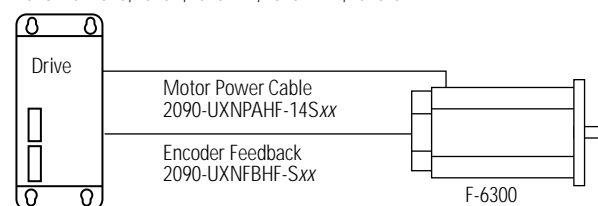
2098-DSD-075, -075X, -075-DN, -075X-DN, -075-SE



2098-DSD-075, -075X, -075-DN, -075X-DN, -075-SE



2098-DSD-075, -075X, -075-DN, -075X-DN, -075-SE



System torque-speed characteristics

Drive module input voltage = 230V AC RMS

Ambient Temperature

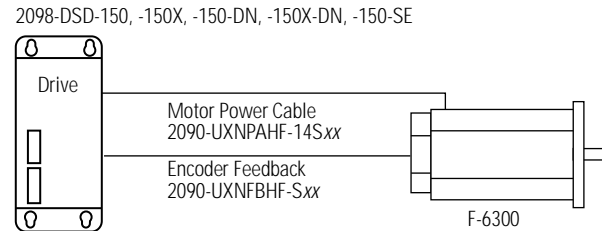
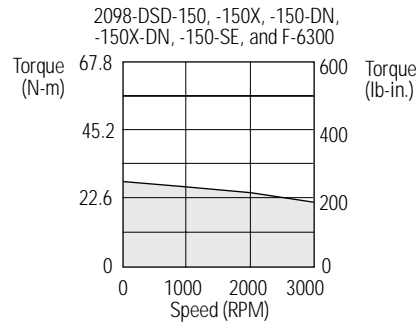
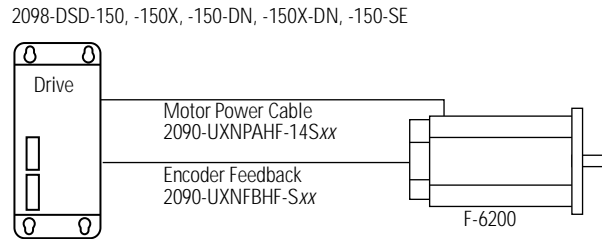
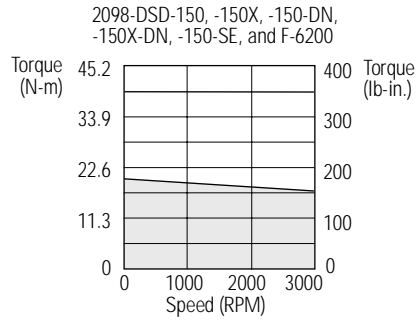
Motors: 0 to 40° C (32 to 104° F)

Drives: 0 to 50° C (32 to 122° F)

□ = Intermittent operating region
■ = Continuous operating region

Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with F-Series Motors, Continued



System torque-speed characteristics

Drive module input voltage = 230V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

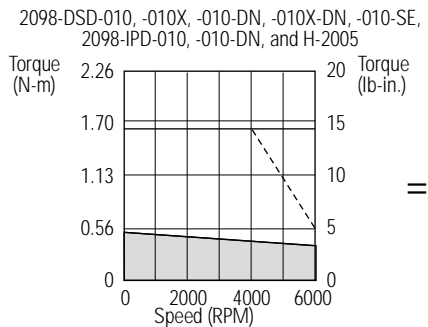
Drives: 0 to 50° C (32 to 122° F)

□ = Intermittent operating region

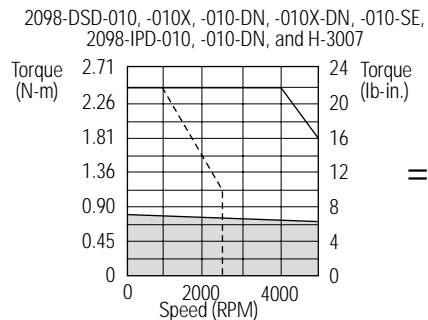
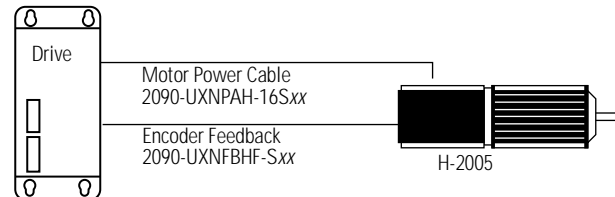
■ = Continuous operating region

Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

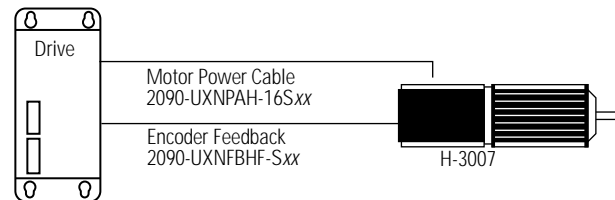
Ultra3000 and Ultra5000 Drives with H-Series Motors



2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN



2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN



System torque-speed characteristics

Drive module input voltage = 230V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

Drives: 0 to 50° C (32 to 122° F)

□ = Intermittent operating region

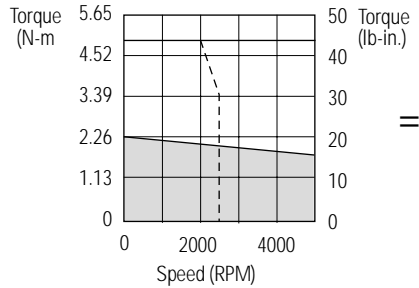
■ = Continuous operating region

--- = Drive operation with 115V AC RMS input voltage

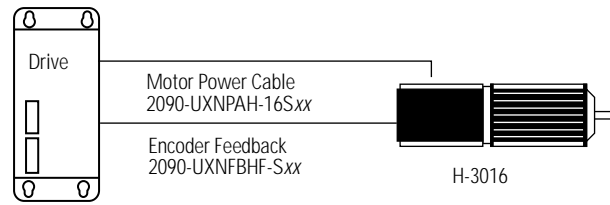
Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with H-Series Motors, Continued

2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE,
2098-IPD-020, -020-DN, and H-3016

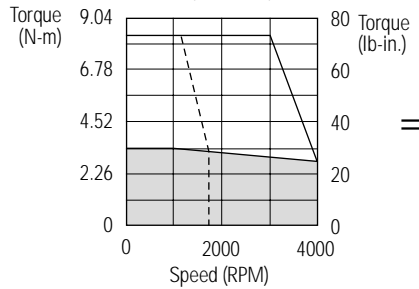


2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE
2098-IPD-020, -020-DN

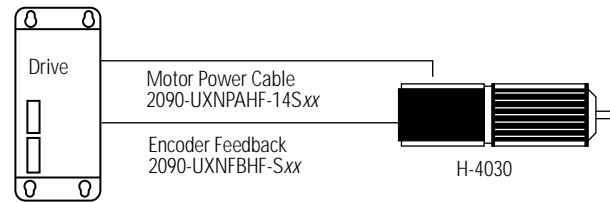


H-3016

2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE,
2098-IPD-020, -020-DN, and H-4030

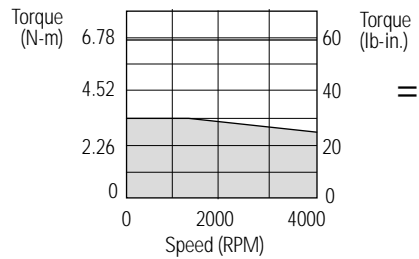


2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE
2098-IPD-020, -020-DN

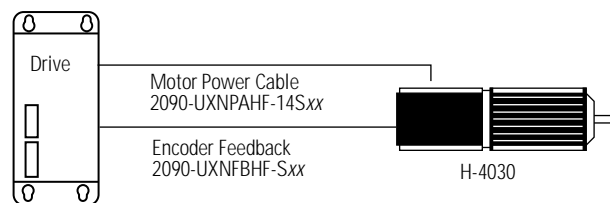


H-4030

2098-DSD-030, -030X, -030-DN,
-030X-DN, -030-SE, and H-4030

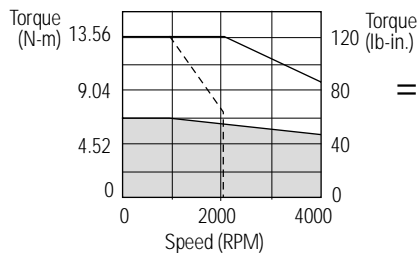


2098-DSD-030, -030X, -030-DN, -030X-DN, -030-SE

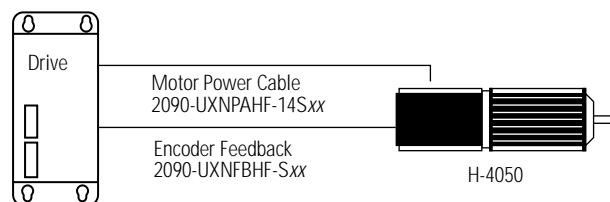


H-4030

2098-DSD-030, -030X, -030-DN,
-030X-DN, -030-SE, and H-4050



2098-DSD-030, -030X, -030-DN, -030X-DN, -030-SE



H-4050




System torque-speed characteristics

Drive module input voltage = 230V AC RMS

Ambient Temperature

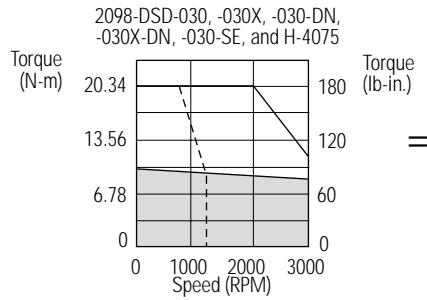
Motors: 0 to 40° C (32 to 104° F)

Drives: 0 to 50° C (32 to 122° F)

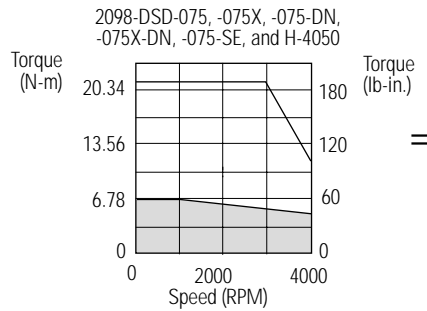
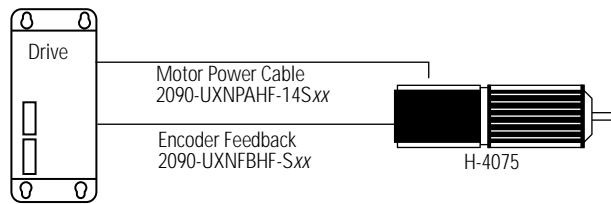
-  = Intermittent operating region
-  = Continuous operating region
-  = Drive operation with 115V AC RMS input voltage

Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

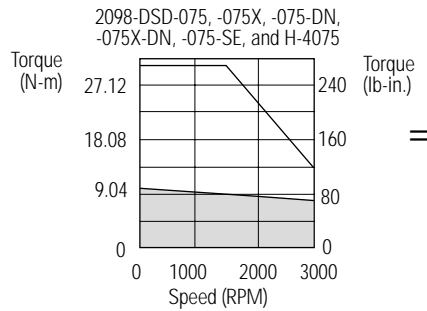
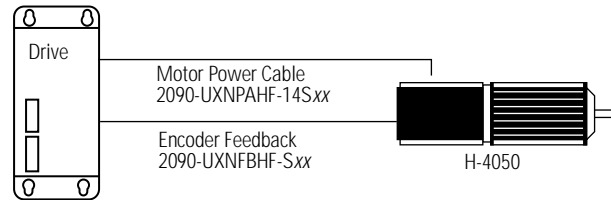
Ultra3000 and Ultra5000 Drives with H-Series Motors, Continued



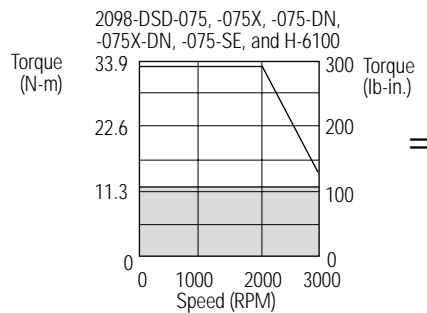
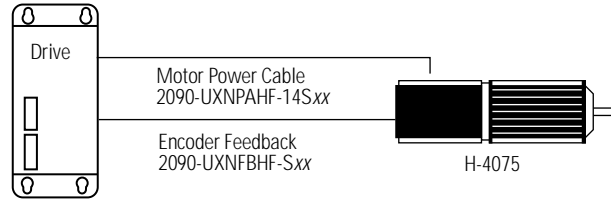
2098-DSD-030, -030X, -030-DN, -030X-DN, -030-SE



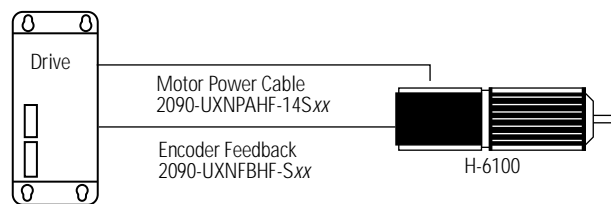
2098-DSD-075, -075X, -075-DN, -075X-DN, -075-SE



2098-DSD-075, -075X, -075-DN, -075X-DN, -075-SE



2098-DSD-075, -075X, -075-DN, -075X-DN, -075-SE

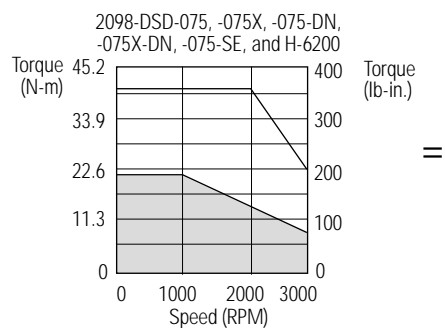


System torque-speed characteristics
Drive module input voltage = 230V AC RMS
Ambient Temperature
Motors: 0 to 40° C (32 to 104° F)
Drives: 0 to 50° C (32 to 122° F)

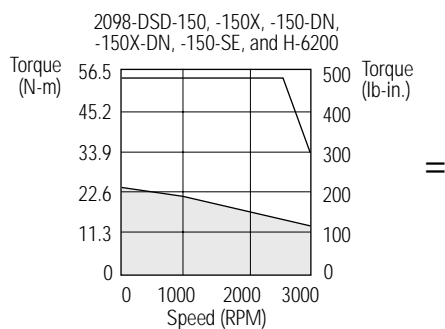
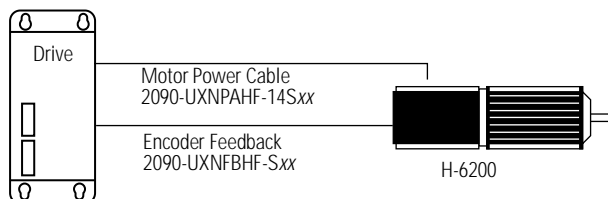
□ = Intermittent operating region
■ = Continuous operating region
--- = Drive operation with 115V AC RMS input voltage

Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

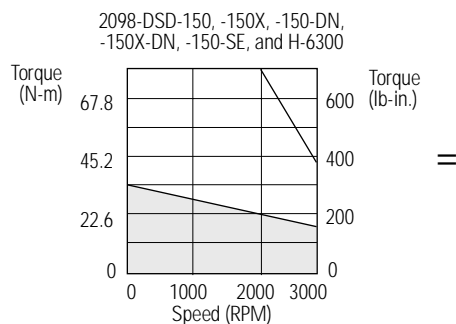
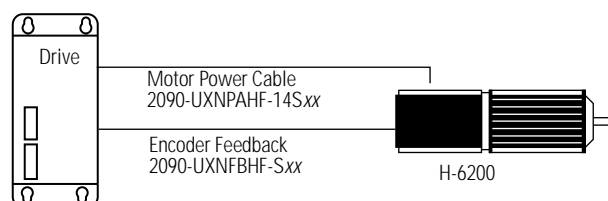
Ultra3000 and Ultra5000 Drives with H-Series Motors, Continued



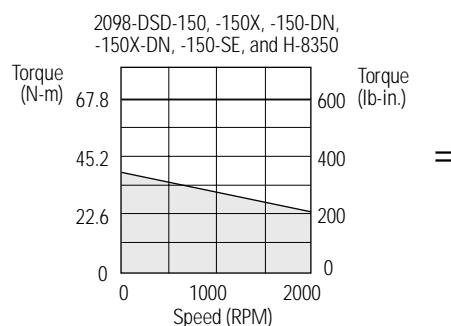
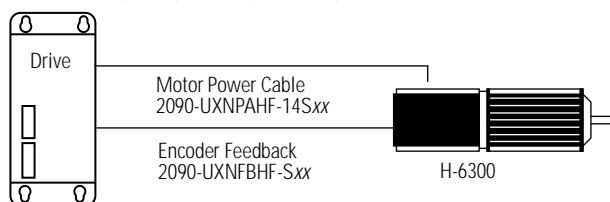
2098-DSD-075, -075X, -075-DN, -075X-DN, -075-SE



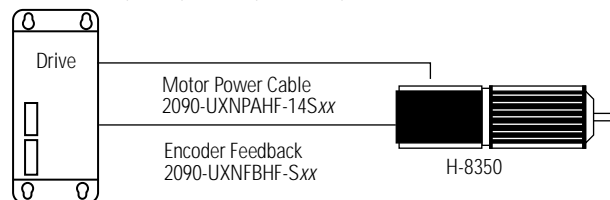
2098-DSD-150, -150X, -150-DN, -150X-DN, -150-SE



2098-DSD-150, -150X, -150-DN, -150X-DN, -150-SE



2098-DSD-150, -150X, -150-DN, -150X-DN, -150-SE



System torque-speed characteristics

Drive module input voltage = 230V AC RMS

Ambient Temperature

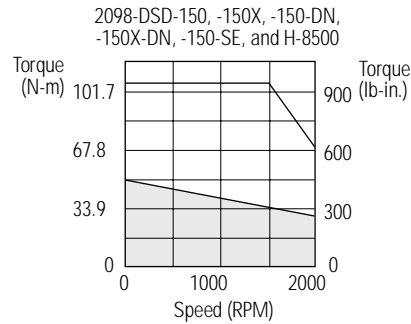
Motors: 0 to 40° C (32 to 104° F)

Drives: 0 to 50° C (32 to 122° F)

□ = Intermittent operating region
 ■ = Continuous operating region

Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with H-Series Motors, Continued



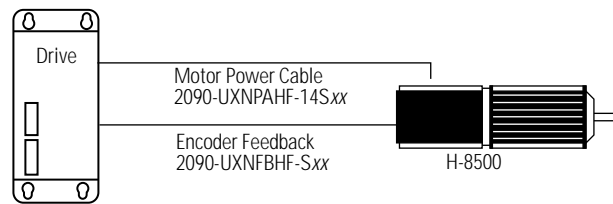
System torque-speed characteristics
Drive module input voltage = 230V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

Drives: 0 to 50° C (32 to 122° F)

2098-DSD-150, -150X, -150-DN, -150X-DN, -150-SE

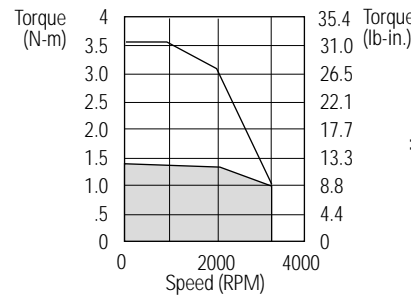


□ = Intermittent operating region
■ = Continuous operating region

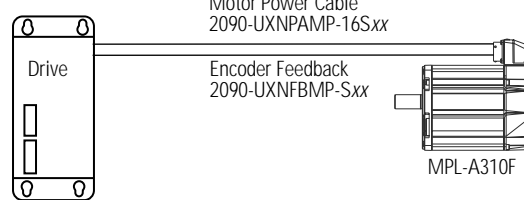
Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with 230V MP-Series Motors

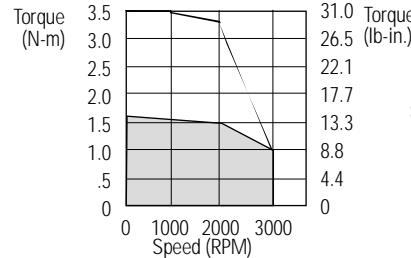
2098-DSD-005, -005X, -005-DN, -005X-DN, -005-SE,
2098-IPD-005, -005-DN, and MPL-A310F



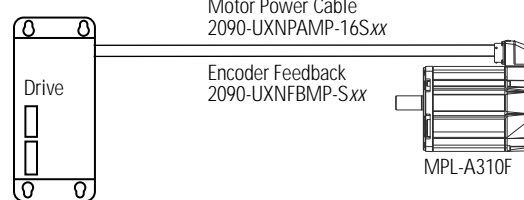
2098-DSD-005, -005X, -005-DN, -005X-DN, -005-SE
2098-IPD-005, -005-DN



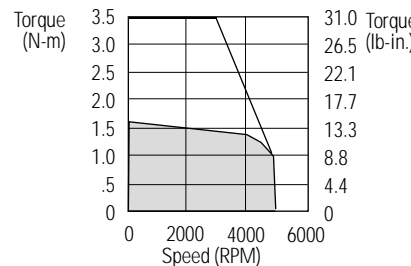
2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE,
2098-IPD-010, -010-DN, and MPL-A310F



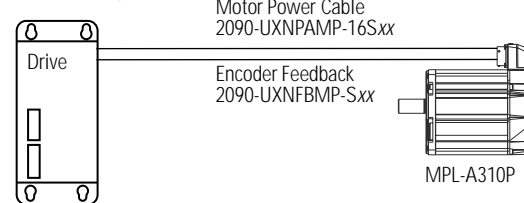
2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN



2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN, and MPL-A310P



2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN



System torque-speed characteristics
Drive module input voltage = 230V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

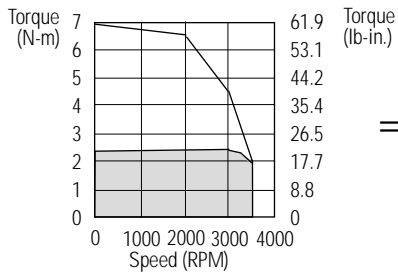
Drives: 0 to 50° C (32 to 122° F)

□ = Intermittent operating region
■ = Continuous operating region

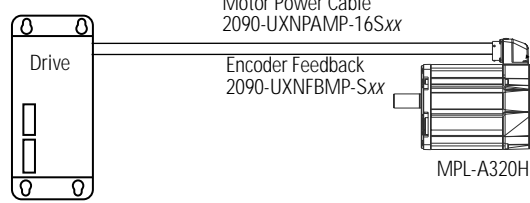
Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with 230V MP-Series Motors, Continued

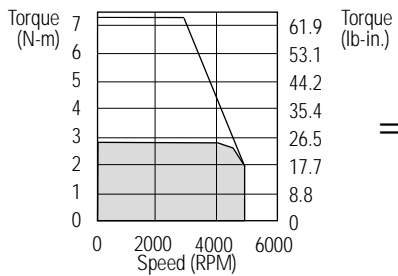
2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN, and MPL-A320H



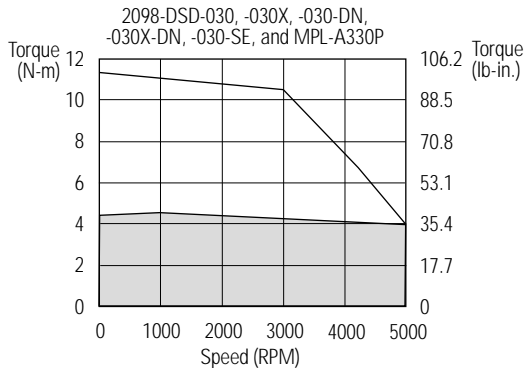
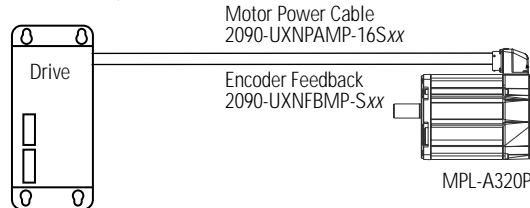
2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN



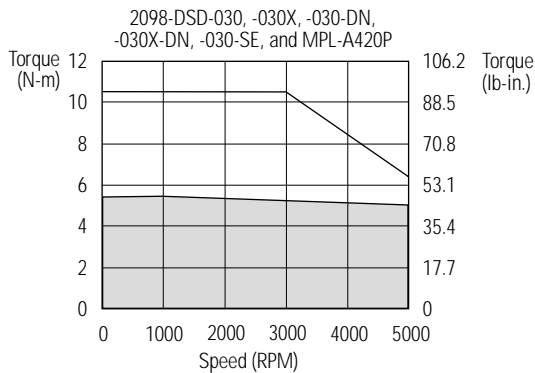
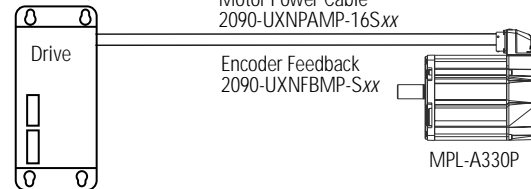
2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE,
2098-IPD-020, -020-DN, and MPL-A320P



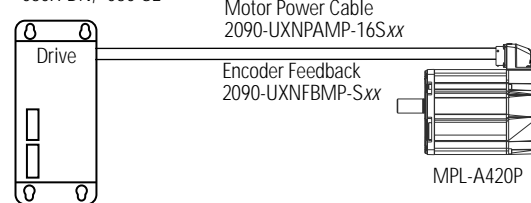
2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE
2098-IPD-020, -020-DN



2098-DSD-030, -030X, -030-DN,
-030X-DN, -030-SE



2098-DSD-030, -030X, -030-DN,
-030X-DN, -030-SE



System torque-speed characteristics

Drive module input voltage = 230V AC RMS

Ambient Temperature

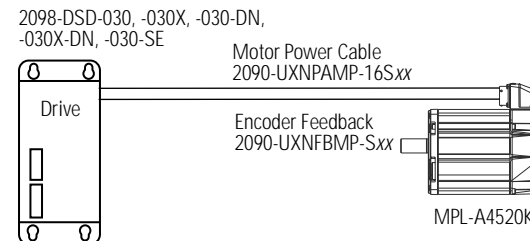
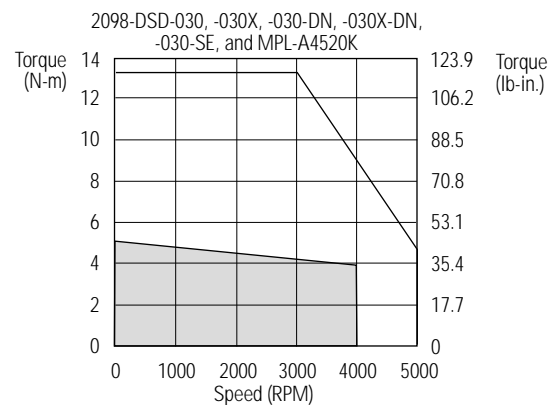
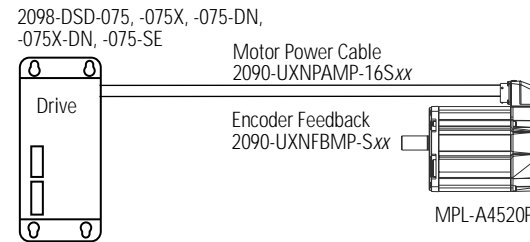
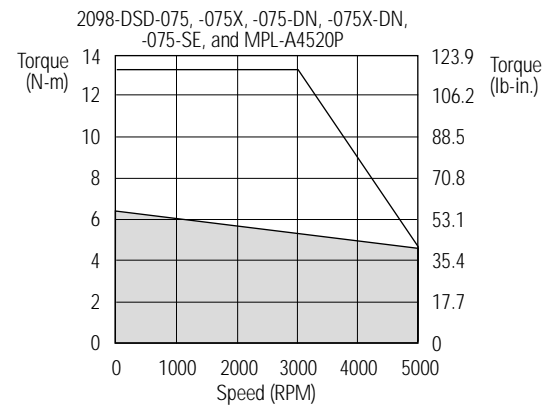
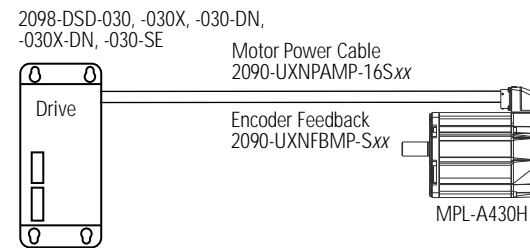
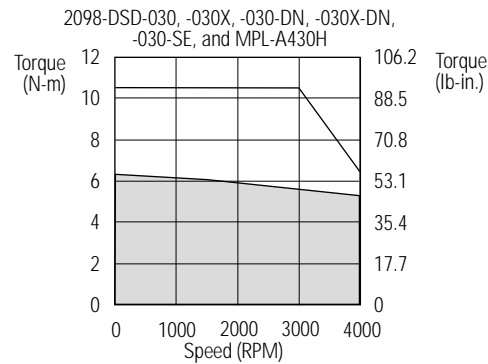
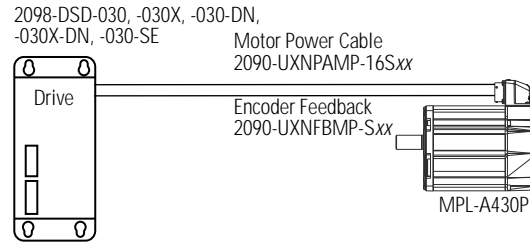
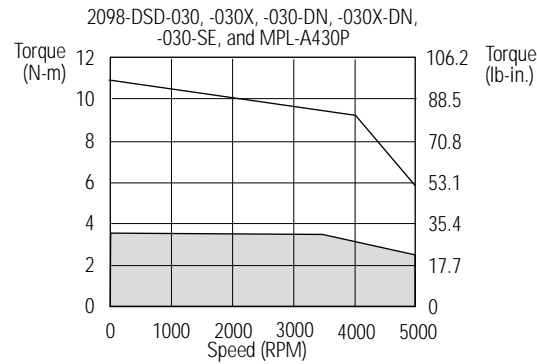
Motors: 0 to 40° C (32 to 104° F)

Drives: 0 to 50° C (32 to 122° F)

□ = Intermittent operating region
■ = Continuous operating region

Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with 230V MP-Series Motors, Continued



System torque-speed characteristics

Drive module input voltage = 230V AC RMS

Ambient Temperature

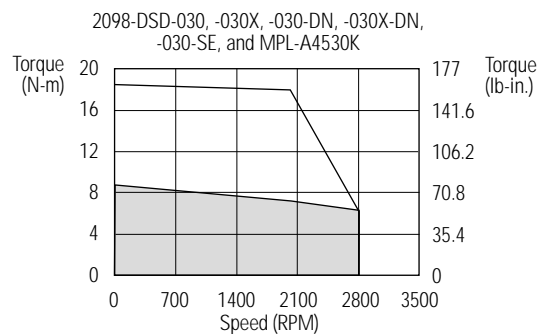
Motors: 0 to 40° C (32 to 104° F)

Drives: 0 to 50° C (32 to 122° F)

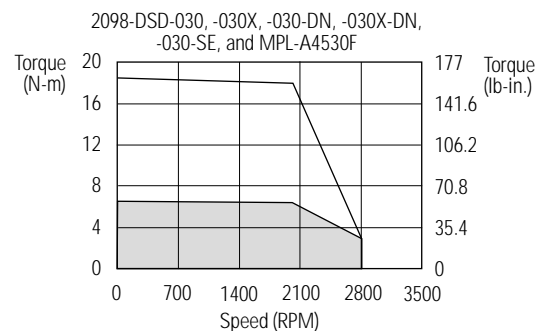
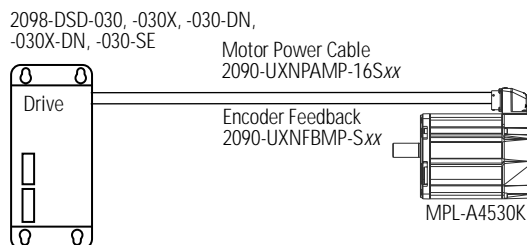
□ = Intermittent operating region
■ = Continuous operating region

Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

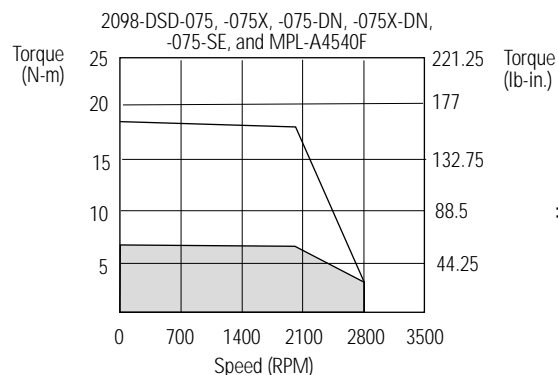
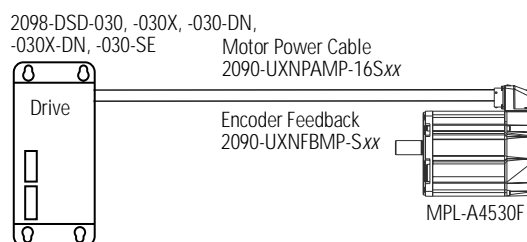
Ultra3000 and Ultra5000 Drives with 230V MP-Series Motors, Continued



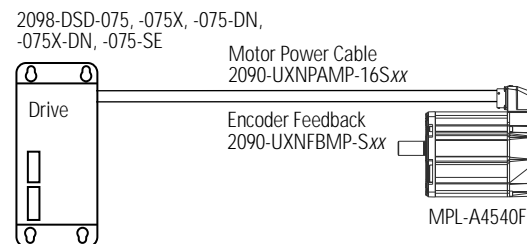
=



=



=



System torque-speed characteristics
Drive module input voltage = 230V AC RMS

Ambient Temperature

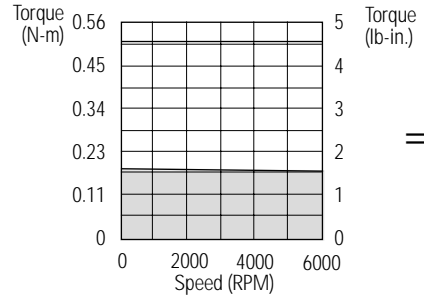
Motors: 0 to 40° C (32 to 104° F)
Drives: 0 to 50° C (32 to 122° F)

□ = Intermittent operating region
■ = Continuous operating region

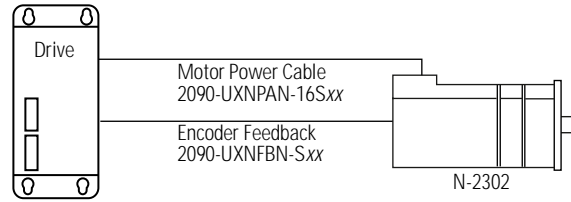
Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with N-Series Motors

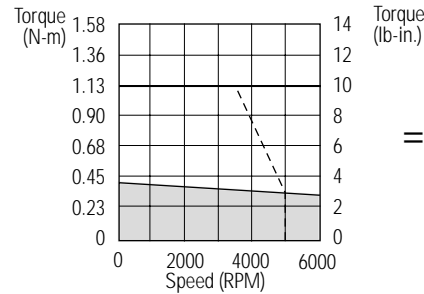
2098-DSD-005, -005X, -005-DN, -005X-DN, -005-SE,
2098-IPD-005, -005-DN, and N-2302



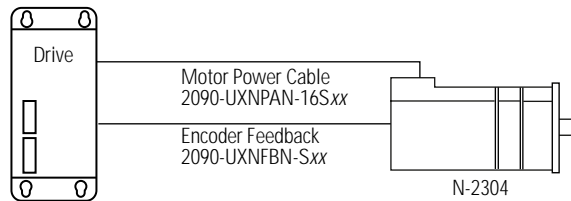
2098-DSD-005, -005X, -005-DN, -005X-DN, -005-SE
2098-IPD-005, -005-DN



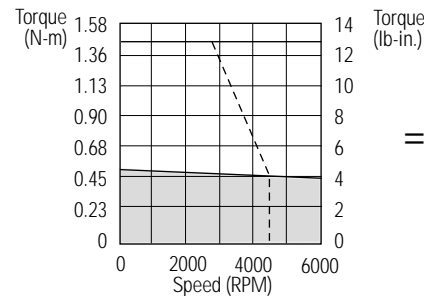
2098-DSD-005, -005X, -005-DN, -005X-DN, -005-SE,
2098-IPD-005, -005-DN, and N-2304



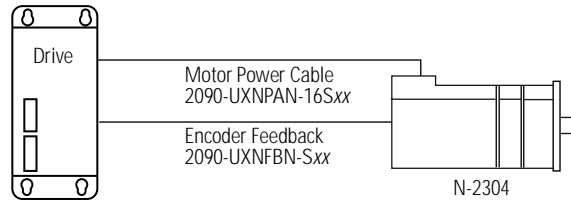
2098-DSD-005, -005X, -005-DN, -005X-DN, -005-SE
2098-IPD-005, -005-DN



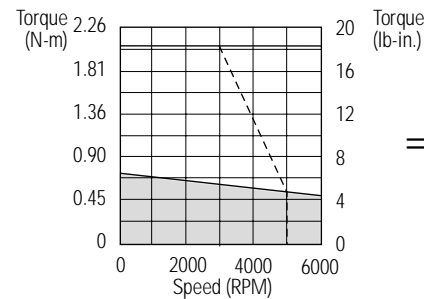
2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE,
2098-IPD-010, -010-DN, and N-2304



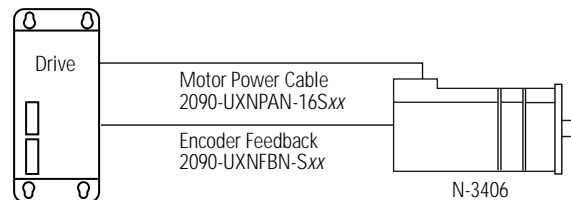
2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN



2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE,
2098-IPD-010, -010-DN, and N-3406



2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN



System torque-speed characteristics

Drive module input voltage = 230V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

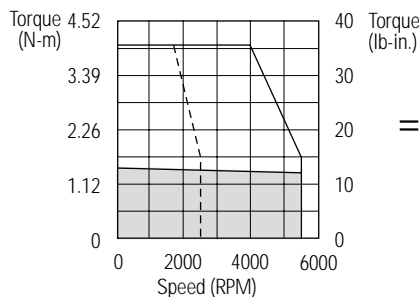
Drives: 0 to 50° C (32 to 122° F)

= Intermittent operating region
 = Continuous operating region
 = Drive operation with 115V AC RMS input voltage

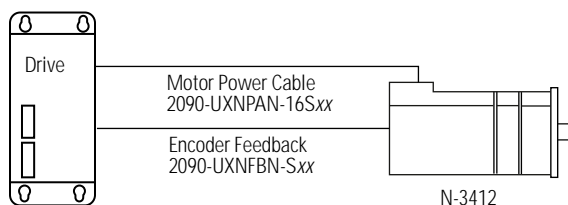
Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with N-Series Motors, Continued

2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE,
2098-IPD-010, -010-DN, and N-3412

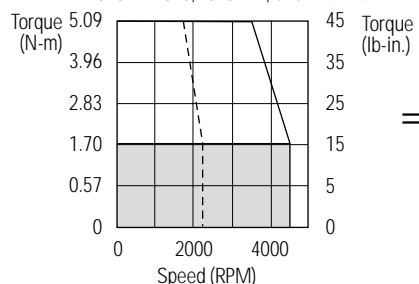


2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN

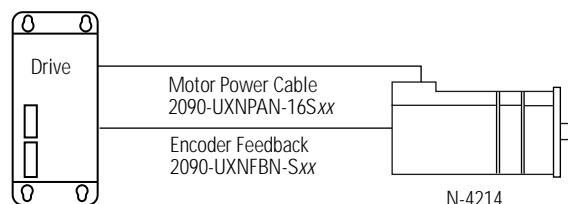


N-3412

2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE,
2098-IPD-010, -010-DN, and N-4214

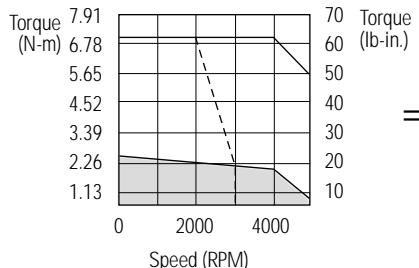


2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN

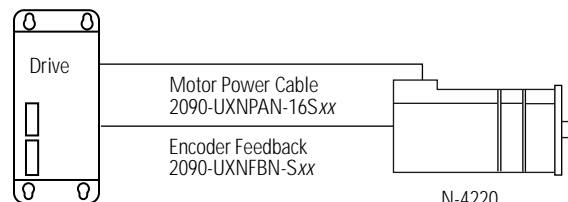


N-4214

2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE,
2098-IPD-020, -020-DN, and N-4220

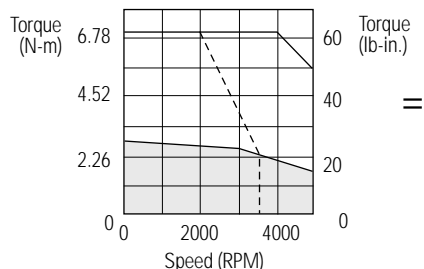


2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE
2098-IPD-020, -020-DN

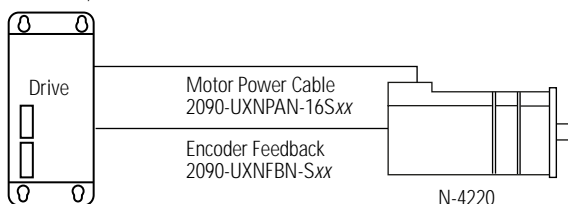


N-4220

2098-DSD-030, -030X, -030-DN, -030X-DN,
-030-SE, and N-4220



2098-DSD-030, -030X, -030-DN,
-030X-DN, -030-SE



N-4220

System torque-speed characteristics

Drive module input voltage = 230V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

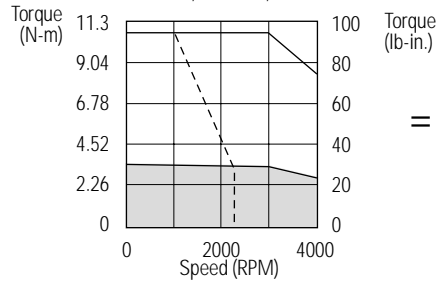
Drives: 0 to 50° C (32 to 122° F)

- = Intermittent operating region
- = Continuous operating region
- = Drive operation with 115V AC RMS input voltage

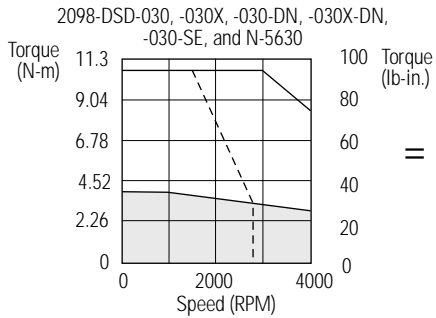
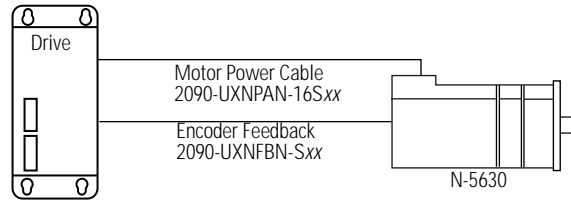
Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with N-Series Motors, Continued

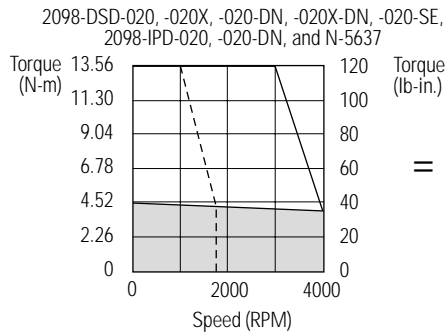
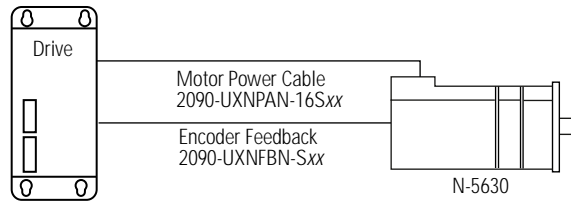
2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE,
2098-IPD-020, -020-DN, and N-5630



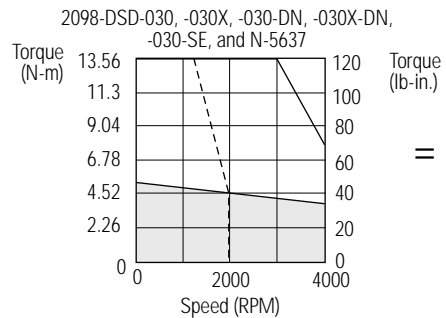
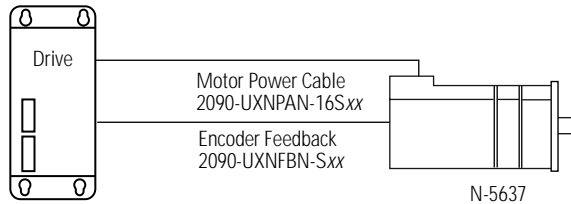
2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE
2098-IPD-020, -020-DN



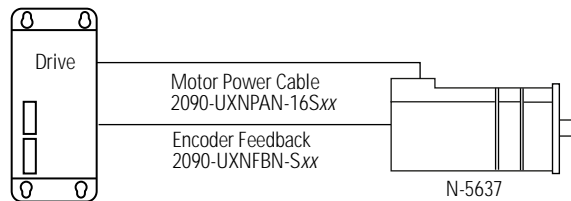
2098-DSD-030, -030X, -030-DN,
-030X-DN, -030-SE



2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE
2098-IPD-020, -020-DN



2098-DSD-030, -030X, -030-DN,
-030X-DN, -030-SE






System torque-speed characteristics

Drive module input voltage = 230V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

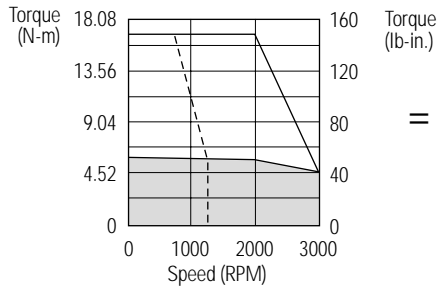
Drives: 0 to 50° C (32 to 122° F)

-  = Intermittent operating region
-  = Continuous operating region
-  = Drive operation with 115V AC RMS input voltage

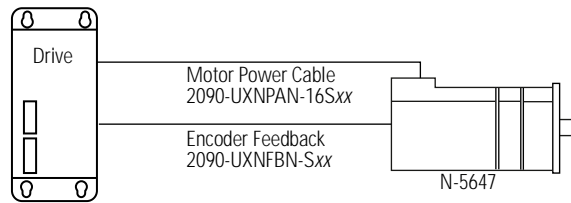
Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with N-Series Motors, Continued

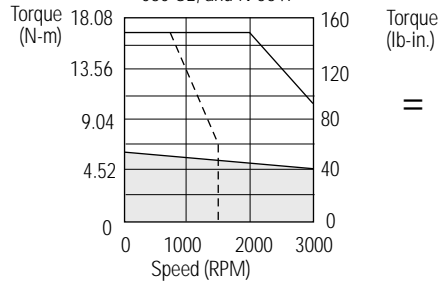
2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE,
2098-IPD-020, -020-DN, and N-5647



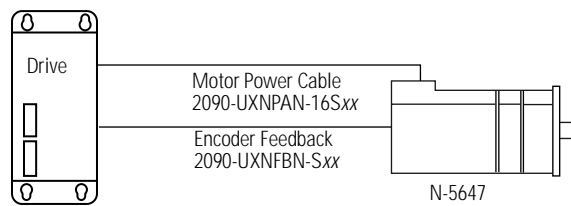
2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE
2098-IPD-020, -020-DN



2098-DSD-030, -030X, -030-DN, -030X-DN,
-030-SE, and N-5647



2098-DSD-030, -030X, -030-DN,
-030X-DN, -030-SE



System torque-speed characteristics

Drive module input voltage = 230V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

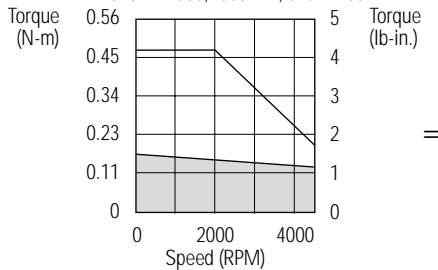
Drives: 0 to 50° C (32 to 122° F)

- = Intermittent operating region
- = Continuous operating region
- = Drive operation with 115V AC RMS input voltage

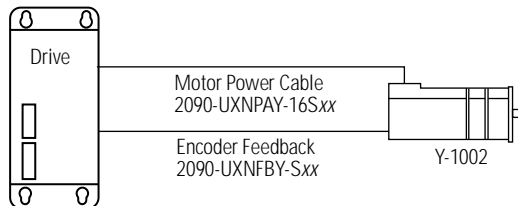
Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with 115V Y-Series Motors

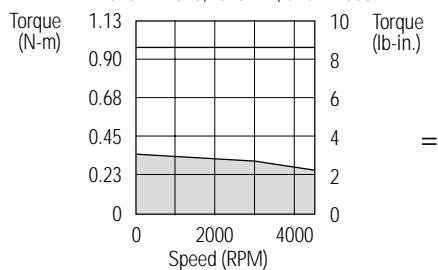
2098-DSD-005, -005X, -005-DN, -005X-DN, -005-SE,
2098-IPD-005, -005-DN, and Y-1002



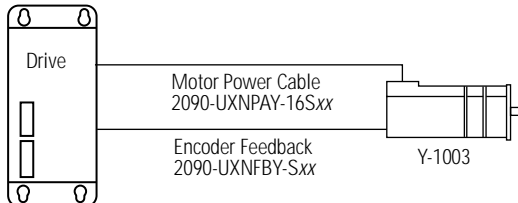
2098-DSD-005, -005X, -005-DN, -005X-DN, -005-SE
2098-IPD-005, -005-DN



2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE,
2098-IPD-010, -010-DN, and Y-1003



2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN



System torque-speed characteristics

Drive module input voltage = 115V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

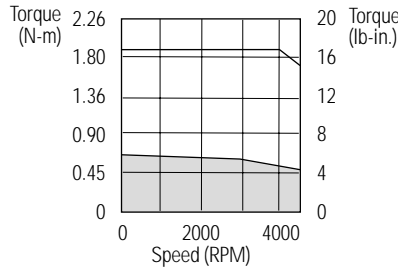
Drives: 0 to 50° C (32 to 122° F)

- = Intermittent operating region
- = Continuous operating region

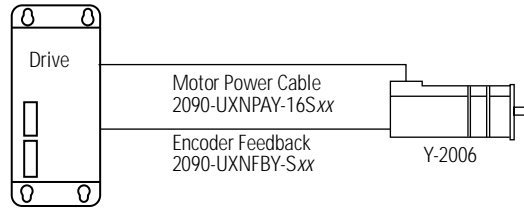
Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with 115V Y-Series Motors, Continued

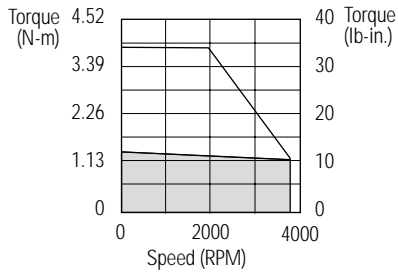
2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE,
2098-IPD-020, -020-DN, and Y-2006



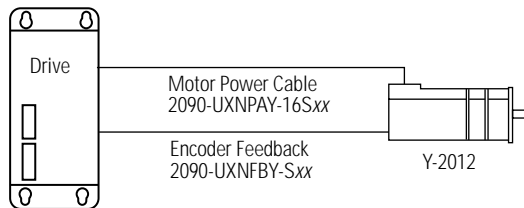
2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE
2098-IPD-020, -020-DN



2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE,
2098-IPD-020, -020-DN, and Y-2012



2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE
2098-IPD-020, -020-DN



System torque-speed characteristics
Drive module input voltage = 115V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

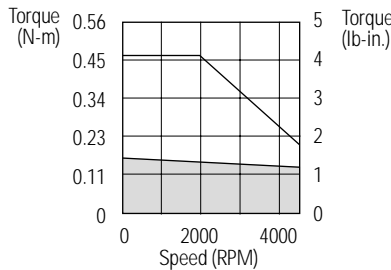
Drives: 0 to 50° C (32 to 122° F)

□ = Intermittent operating region
■ = Continuous operating region

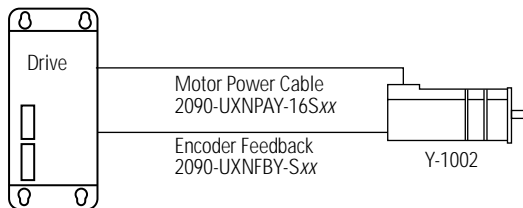
Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with 230V Y-Series Motors

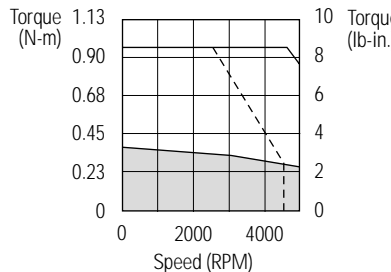
2098-DSD-005, -005X, -005-DN, -005X-DN, -005-SE,
2098-IPD-005, -005-DN, and Y-1002



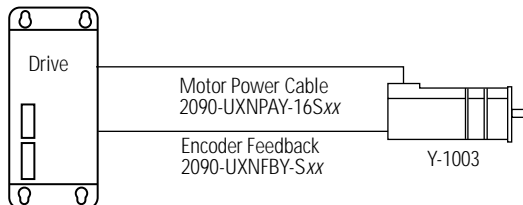
2098-DSD-005, -005X, -005-DN, -005X-DN, -005-SE
2098-IPD-005, -005-DN



2098-DSD-005, -005X, -005-DN, -005X-DN, -005-SE,
2098-IPD-005, -005-DN, and Y-1003



2098-DSD-005, -005X, -005-DN, -005X-DN, -005-SE
2098-IPD-005, -005-DN



System torque-speed characteristics
Drive module input voltage = 230V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

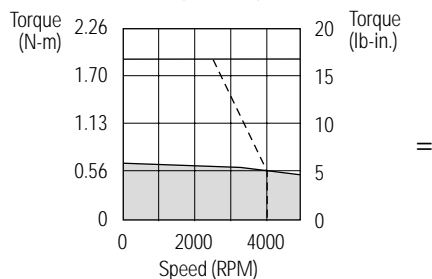
Drives: 0 to 50° C (32 to 122° F)

□ = Intermittent operating region
■ = Continuous operating region
--- = Drive operation with 115V AC RMS input voltage

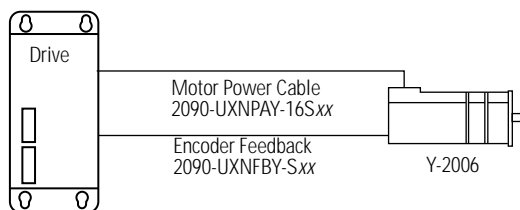
Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 and Ultra5000 Drives with 230V Y-Series Motors, Continued

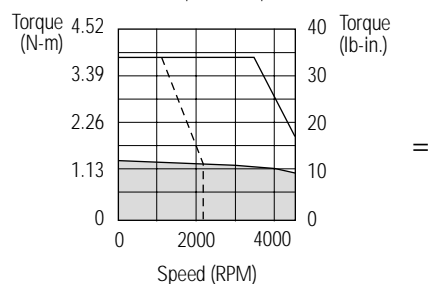
2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE,
2098-IPD-010, -010-DN, and Y-2006



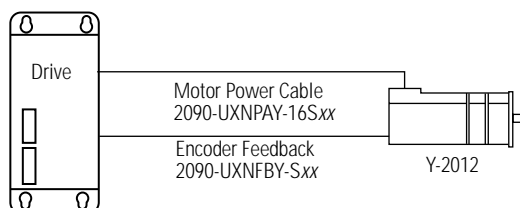
2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN



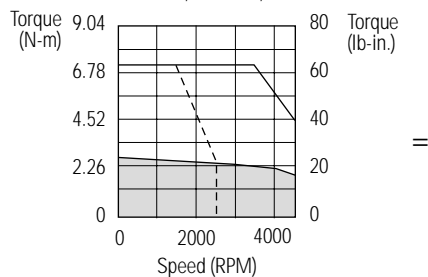
2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE,
2098-IPD-010, -010-DN, and Y-2012



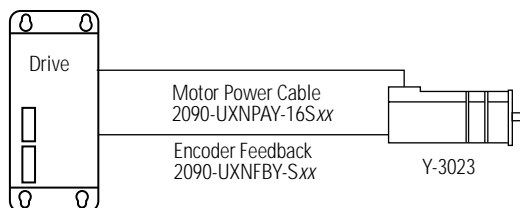
2098-DSD-010, -010X, -010-DN, -010X-DN, -010-SE
2098-IPD-010, -010-DN



2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE,
2098-IPD-020, -020-DN, and Y-3023



2098-DSD-020, -020X, -020-DN, -020X-DN, -020-SE
2098-IPD-020, -020-DN



System torque-speed characteristics

Drive module input voltage = 230V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

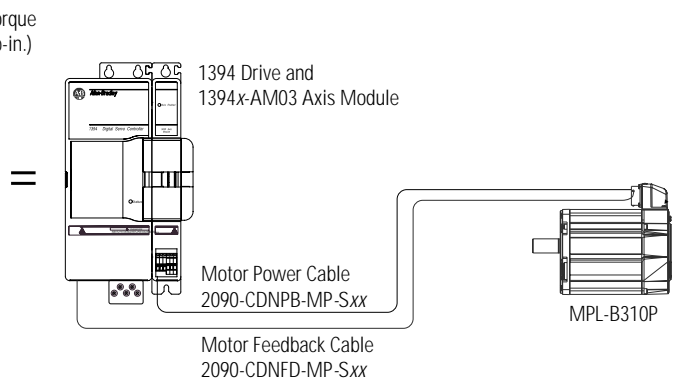
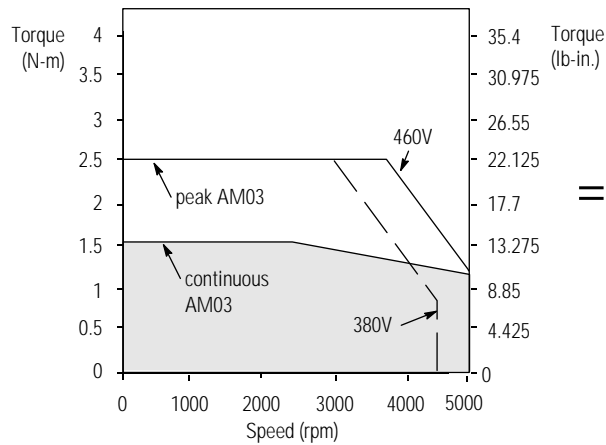
Drives: 0 to 50° C (32 to 122° F)

- = Intermittent operating region
- = Continuous operating region
- = Drive operation with 115V AC RMS input voltage

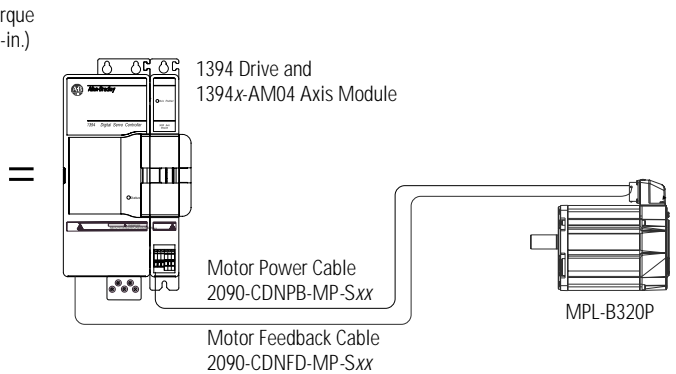
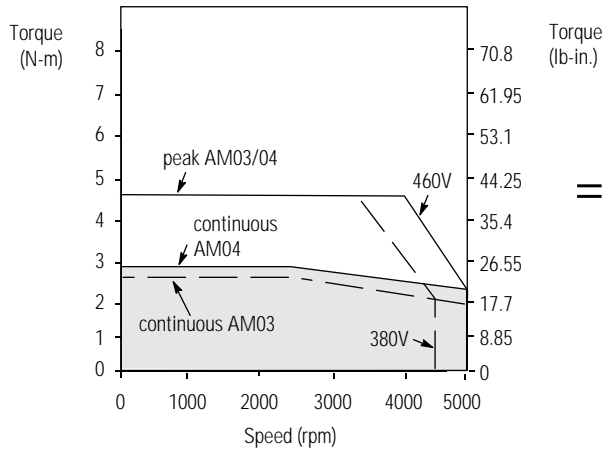
Length of cable xx is in meters: 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

1394 Drive/Axis Modules with 460V MP-Series Motors

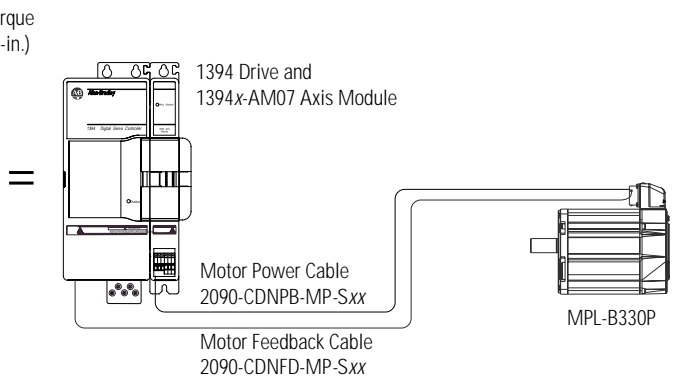
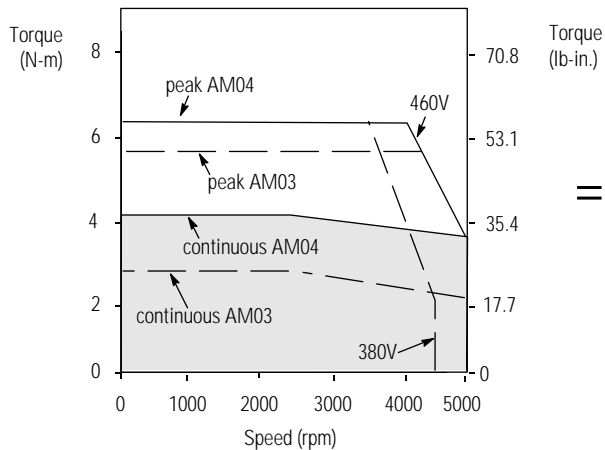
1394 and MPL-B310P



1394 and MPL-B320P



1394 and MPL-B330P



System torque-speed characteristics

Drive module input voltage = 460V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

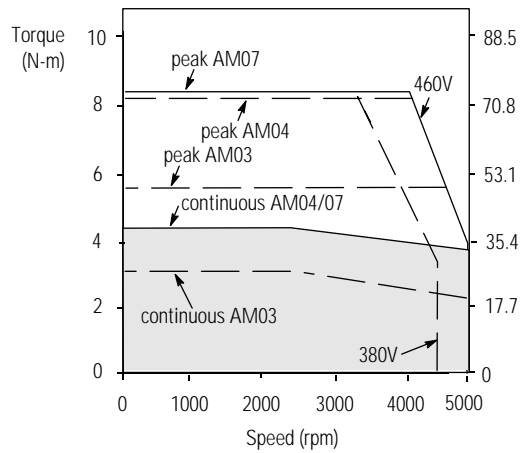
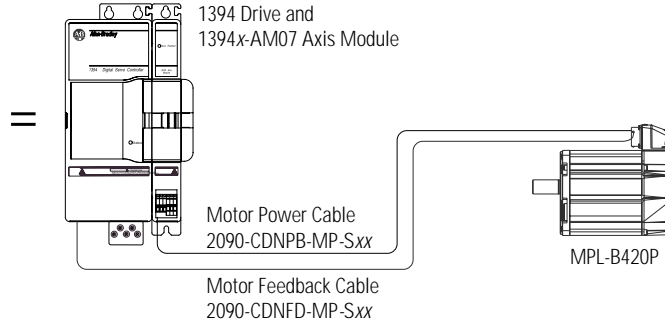
Drives: 0 to 50° C (32 to 122° F)

□ = Intermittent operating region
 ■ = Continuous operating region

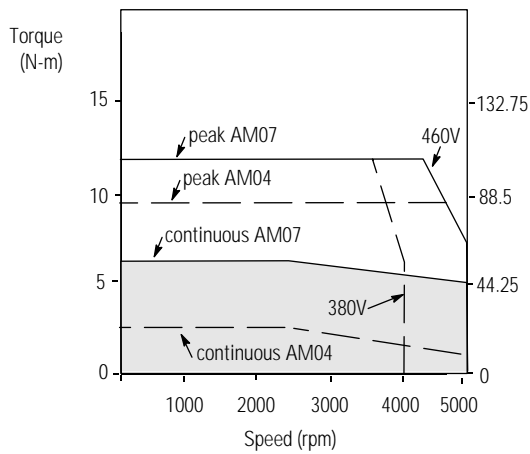
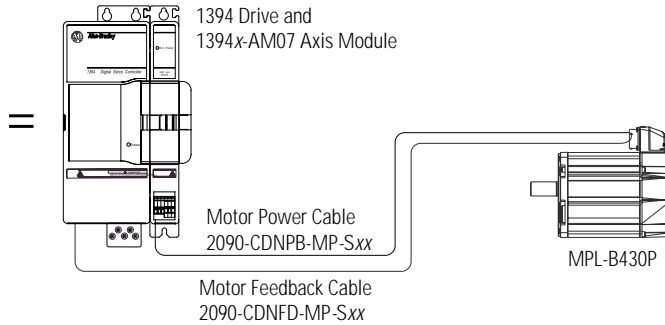
Length of cable xx is in meters: 5, 15, 30, 60, 90 (16.405, 49.2, 98.5, 196.86, 295.29 ft)

1394 Drive/Axis Modules with 460V MP-Series Motors, Continued

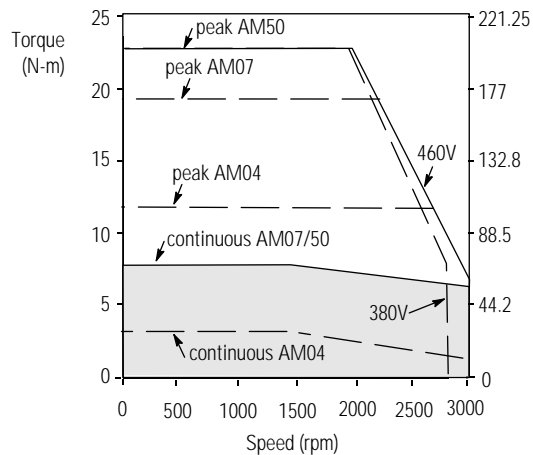
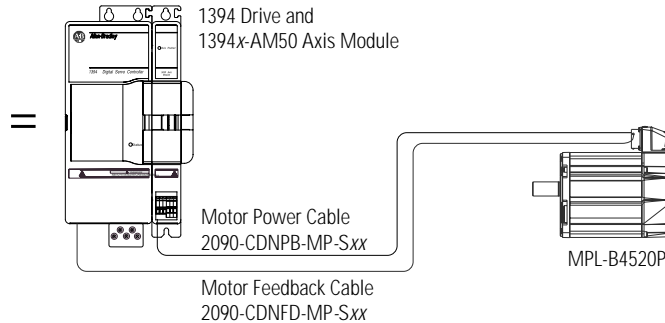
1394 and MPL-B420P

Torque
(lb-in.)

1394 and MPL-430P

Torque
(lb-in.)

1394 and MPL-4520P

Torque
(lb-in.)

System torque-speed characteristics

Drive module input voltage = 460V AC RMS

Ambient Temperature

Motors: 0 to 40° C (32 to 104° F)

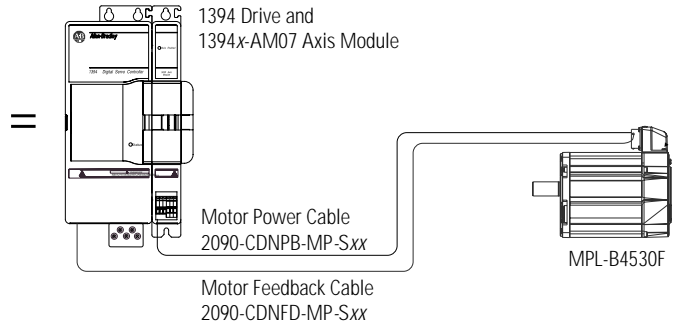
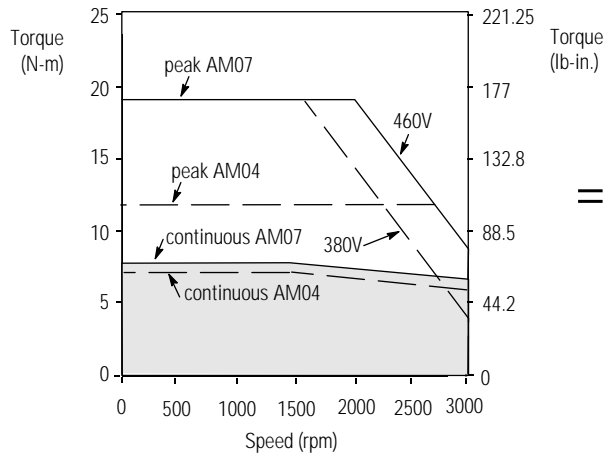
Drives: 0 to 50° C (32 to 122° F)

□ = Intermittent operating region
 ■ = Continuous operating region

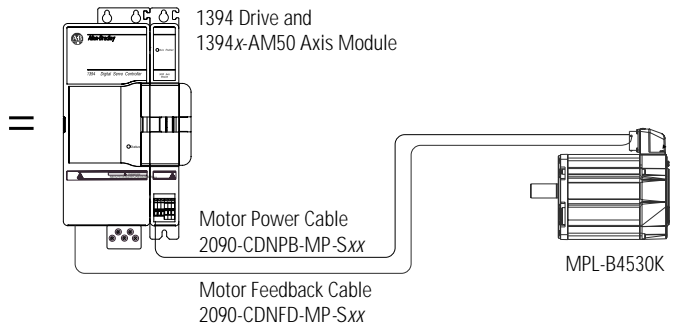
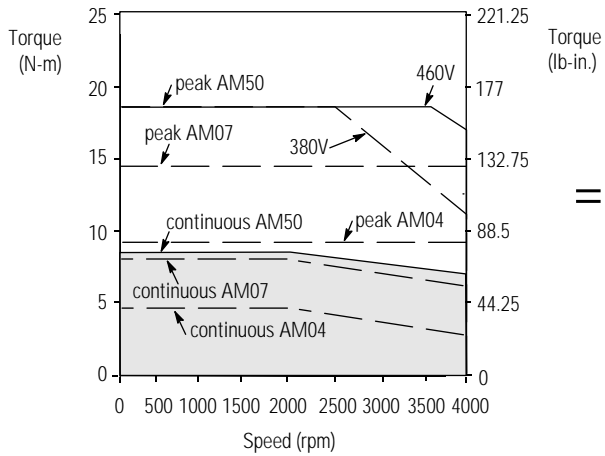
Length of cable xx is in meters: 5, 15, 30, 60, 90 (16.405, 49.2, 98.5, 196.86, 295.29 ft)

1394 Drive/Axis Modules with 460V MP-Series Motors, Continued

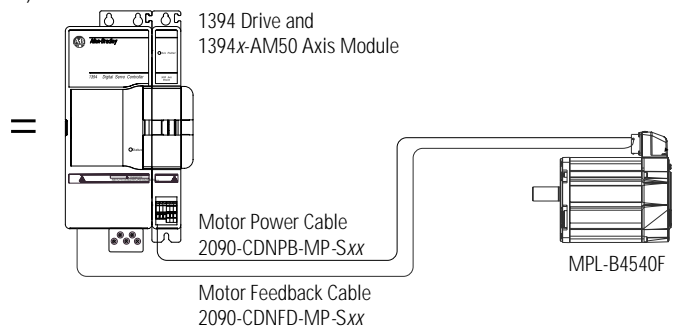
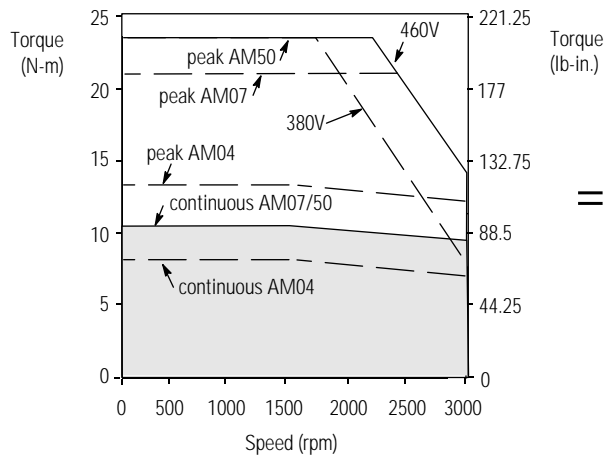
1394 and MPL-4530F



1394 and MPL-4530K



1394 and MPL-4540F



System torque-speed characteristics
Drive module input voltage = 460V AC RMS

Ambient Temperature
Motors: 0 to 40° C (32 to 104° F)
Drives: 0 to 50° C (32 to 122° F)

□ = Intermittent operating region
■ = Continuous operating region

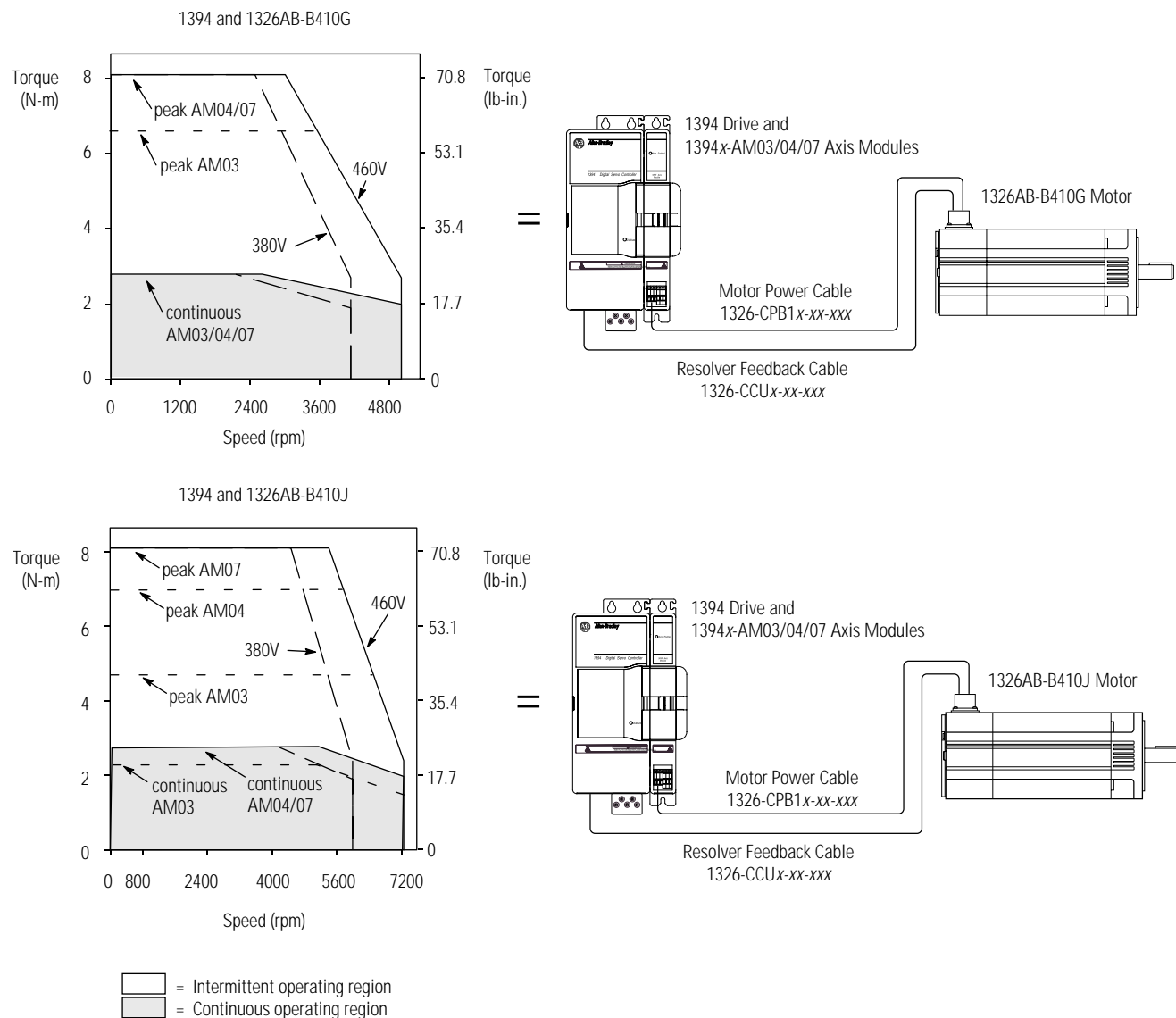
Length of cable xx is in meters: 5, 15, 30, 60, 90 (16.405, 49.2, 98.5, 196.86, 295.29 ft)

1394 Drive/Axis Modules with 1326AB Motors

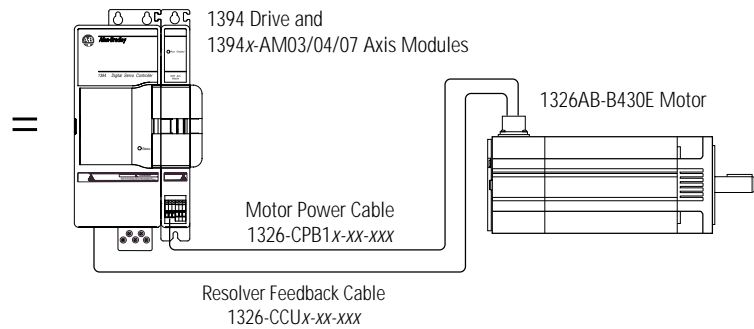
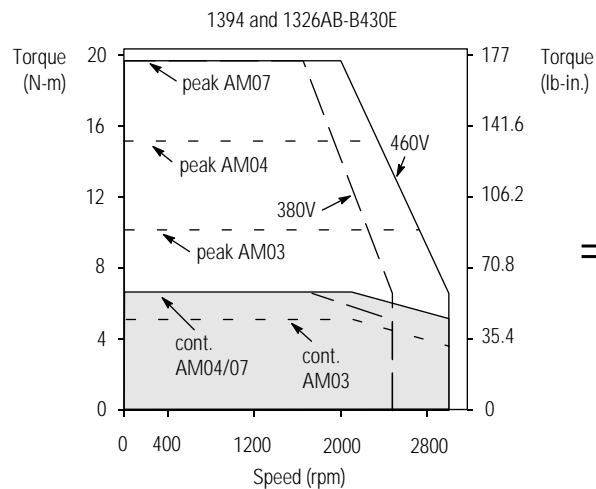
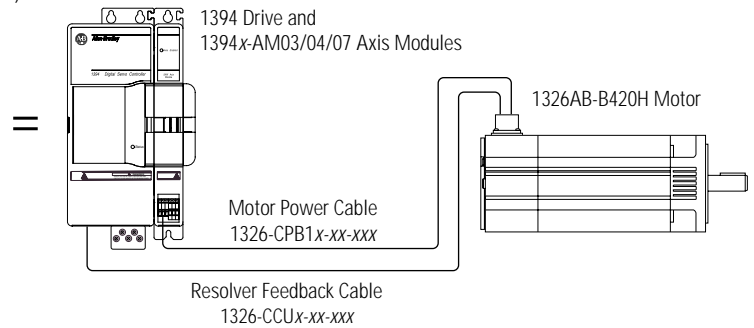
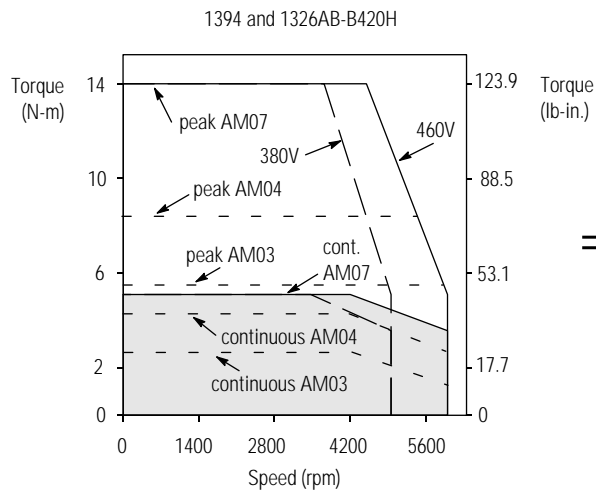
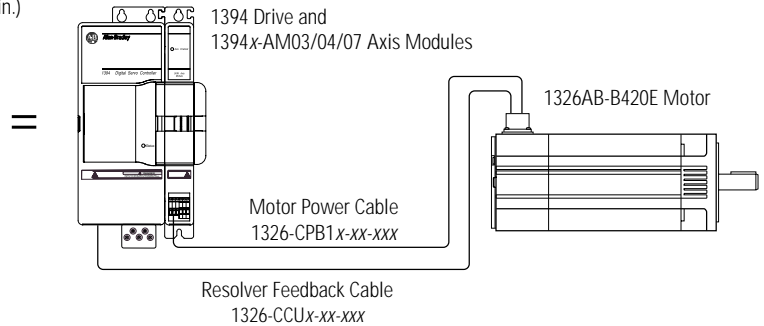
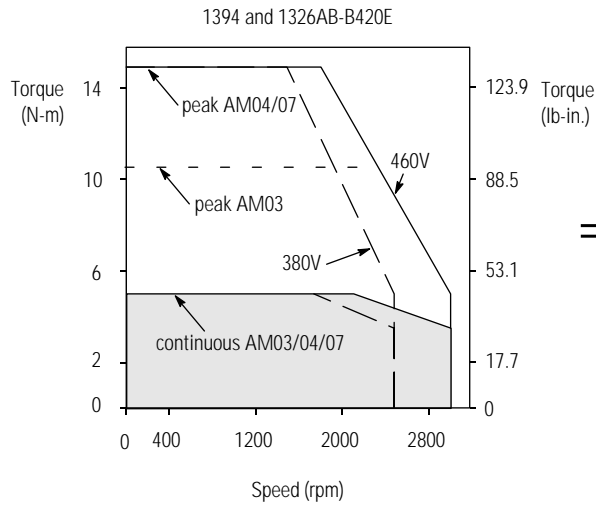
Each motor was tested at a line voltage of 460V AC, in a 40° C (104° F) ambient environment. The case temperature was approximately 100° C (212° F) with the motor windings at an 80° C (176° F) rise over ambient. Torque ratings were determined when the motor was mounted to a 304.8 mm x 304.8 mm x 25.4 mm (12 in. x 12 in. x 1 in.) steel mounting bracket. The motor contains two thermal switches wired in series that open during an overtemperature condition. The switches are set at 155° C (311° F) \pm 10%. Contacts are rated for 1A at 115V AC, 1A at 24V DC. All values shown below have a tolerance of \pm 10%.

IMPORTANT

Refer to the chapter *Motors* for system ratings for specific motor/amplifier combinations.



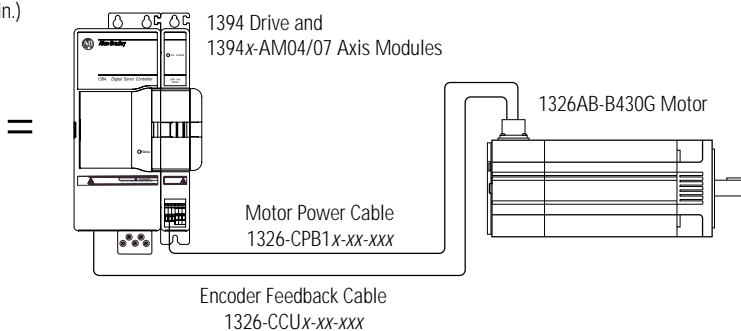
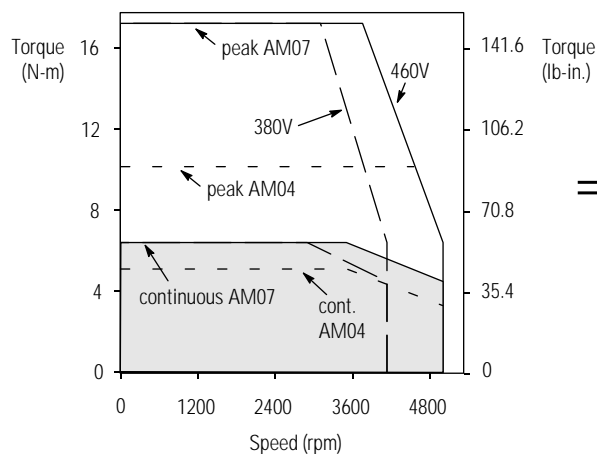
1394 Drive/Axis Modules with 1326AB Motors, Continued



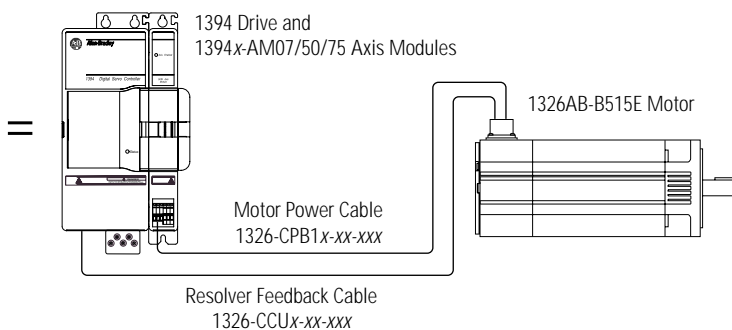
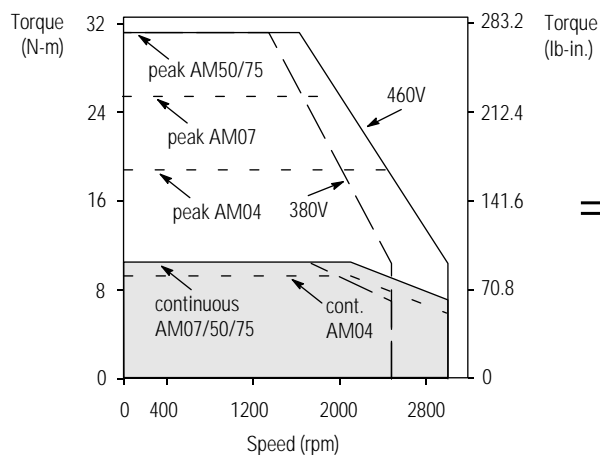
□ = Intermittent operating region
 ■ = Continuous operating region

1394 Drive/Axis Modules with 1326AB Motors, Continued

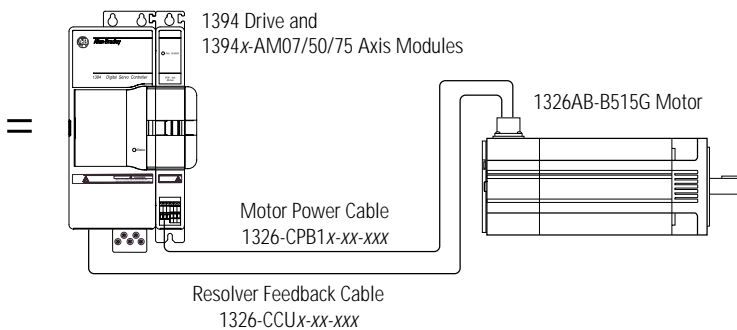
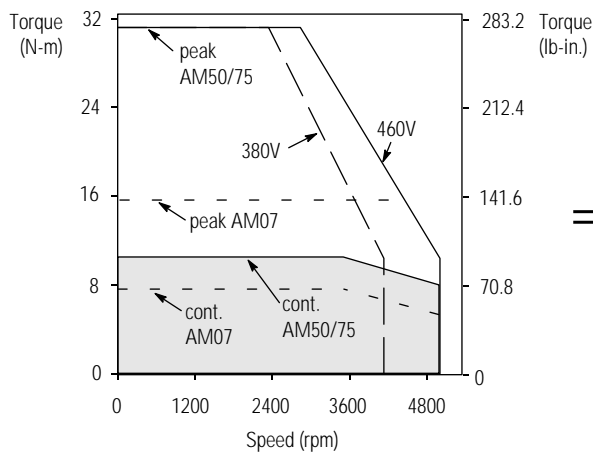
1394 and 1326AB-B430G



1394 and 1326AB-B515E

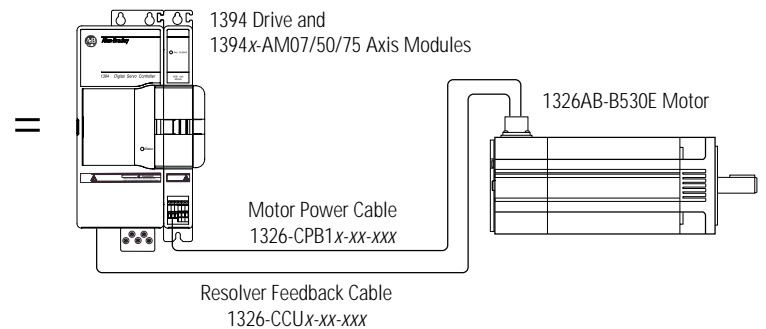
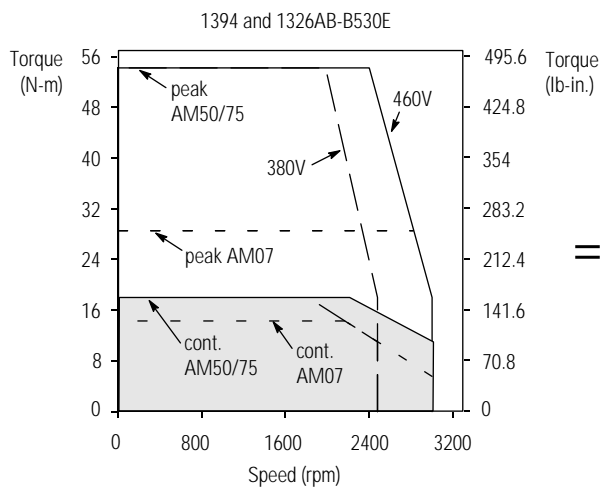
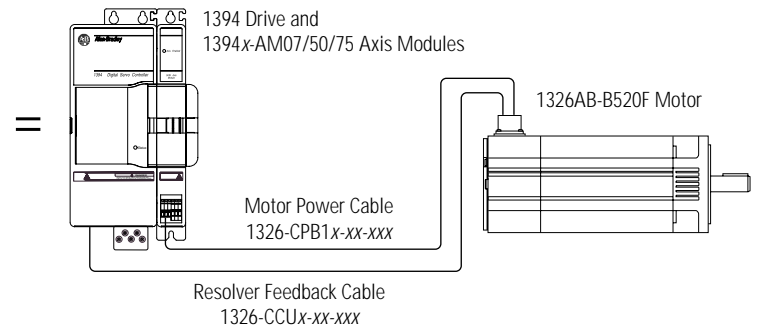
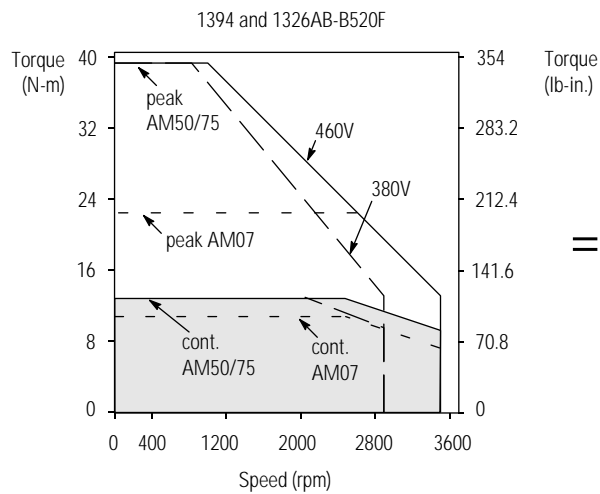
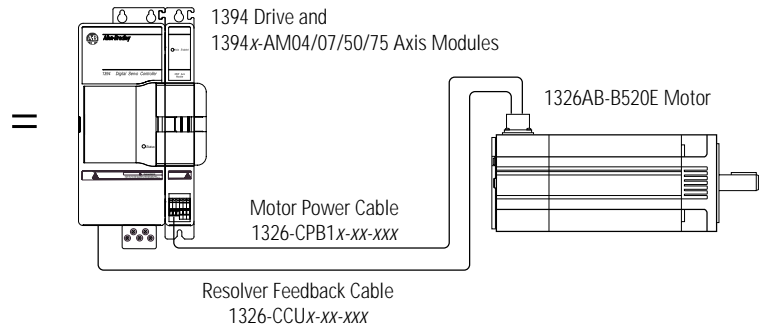
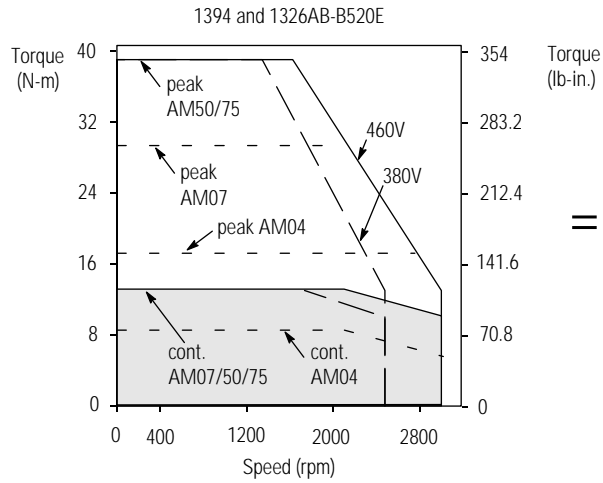


1394 and 1326AB-B515G



= Intermittent operating region
 = Continuous operating region

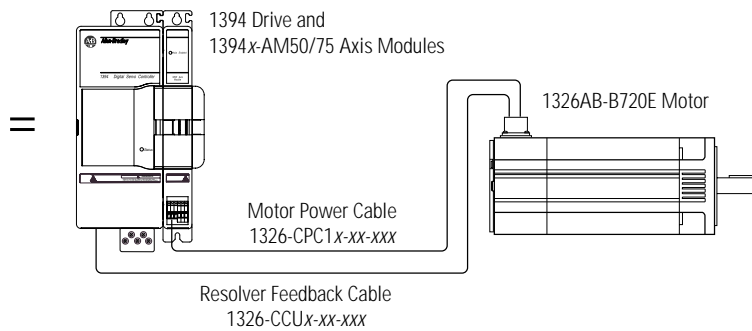
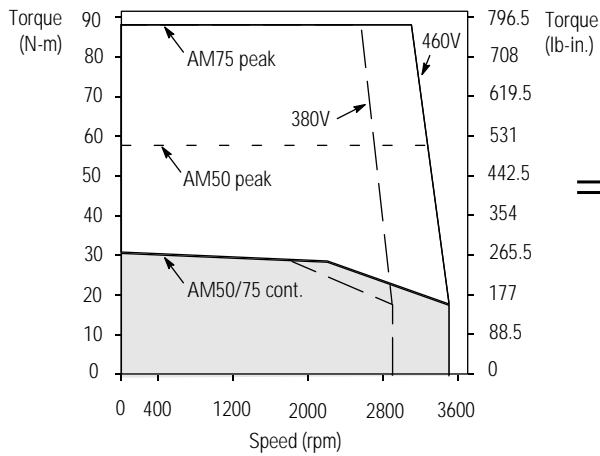
1394 Drive/Axis Modules with 1326AB Motors, Continued



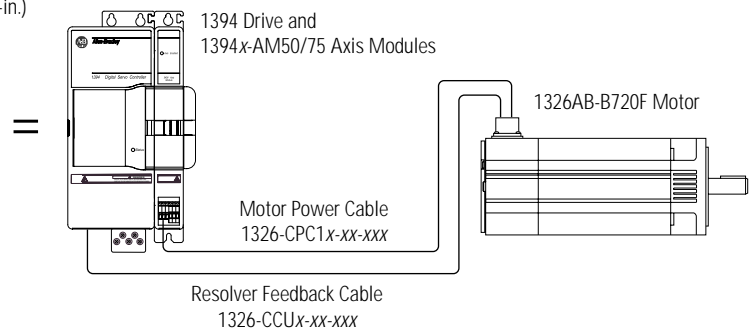
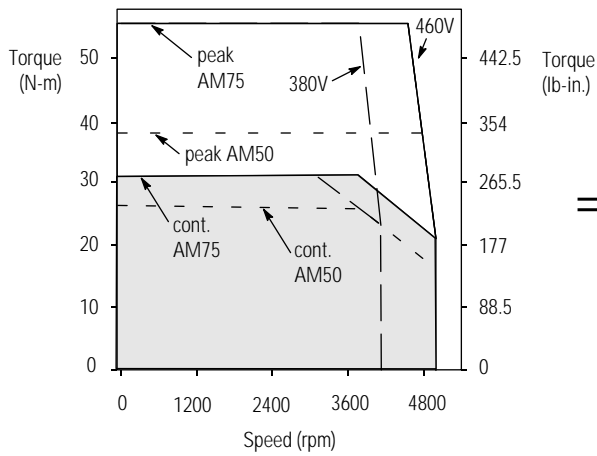
□ = Intermittent operating region
 ■ = Continuous operating region

1394 Drive/Axis Modules with 1326AB Motors, Continued

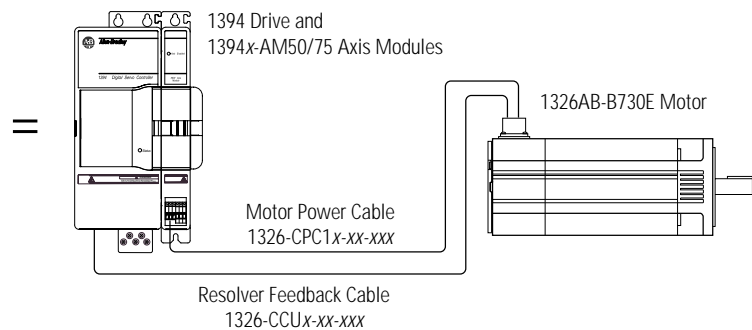
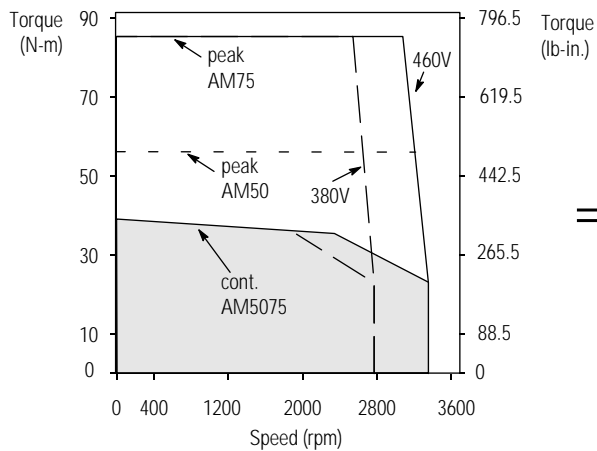
1394 and 1326AB-B720E



1394 and 1326AB-B720F



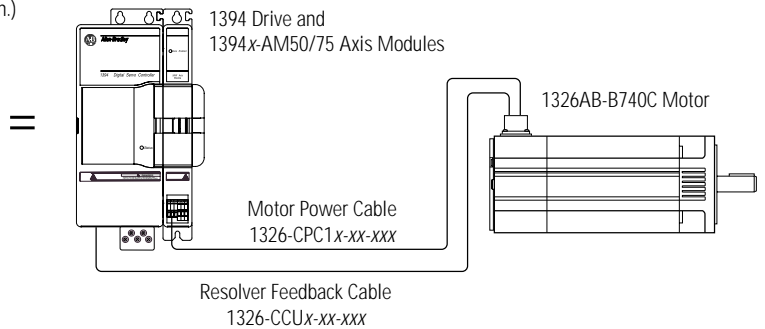
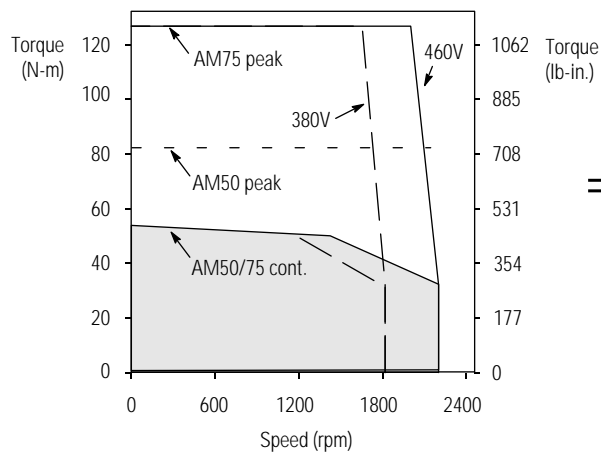
1394 and 1326AB-B730E



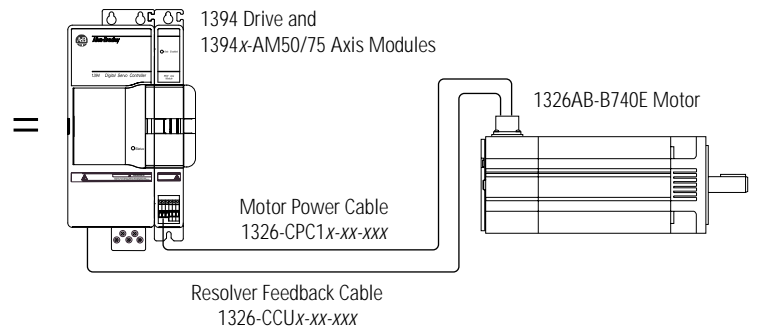
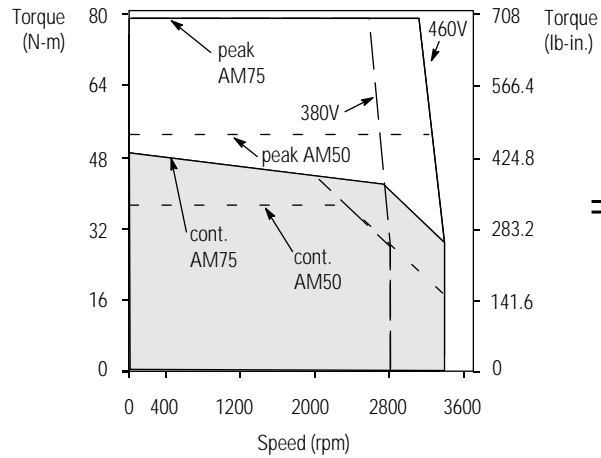
= Intermittent operating region
 = Continuous operating region

1394 Drive/Axis Modules with 1326AB Motors, Continued

1394 and 1326AB-B740C



1394 and 1326AB-B740E



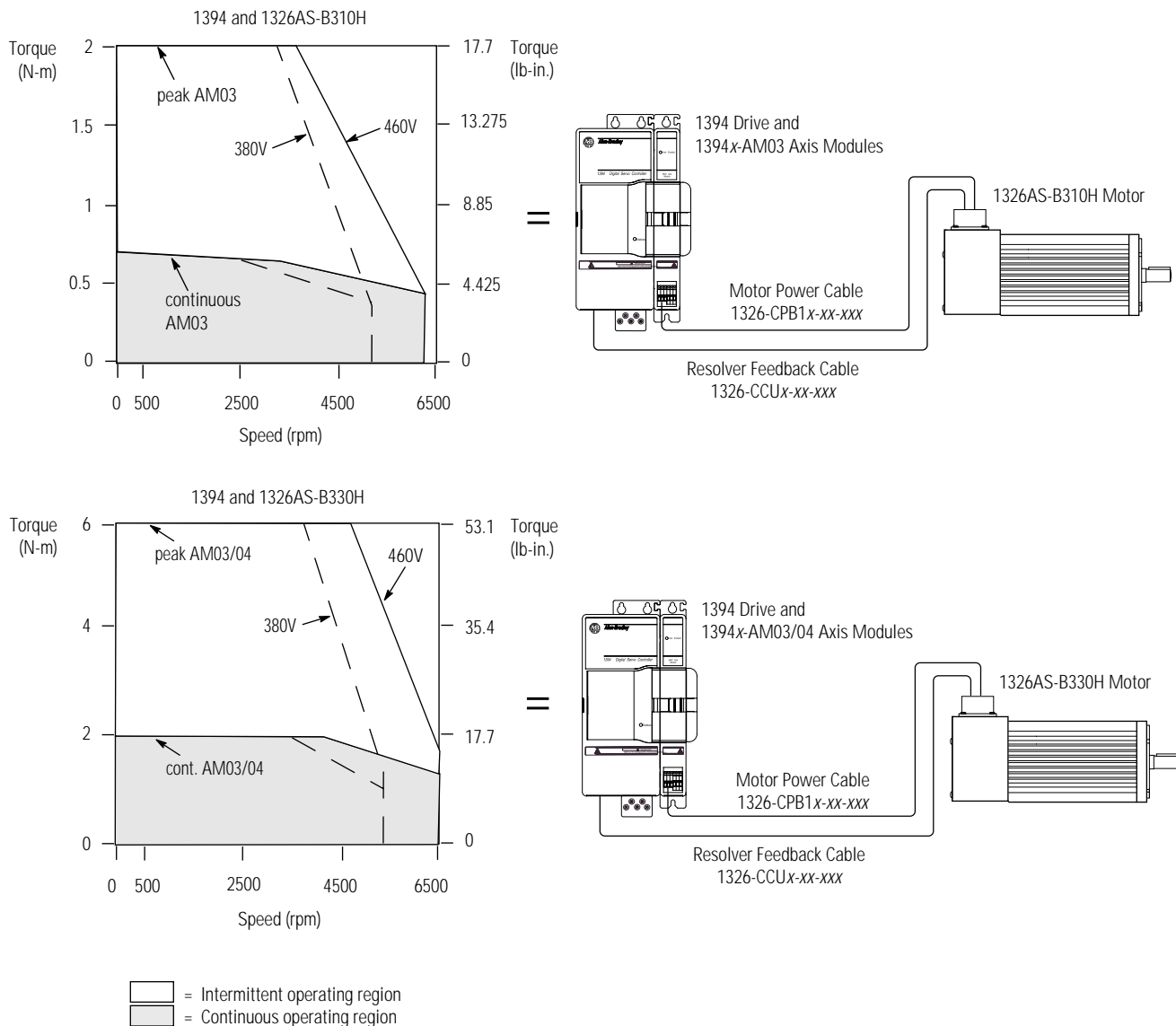
= Intermittent operating region
 = Continuous operating region

1394 Drive/Axis Modules with 1326AS Motors

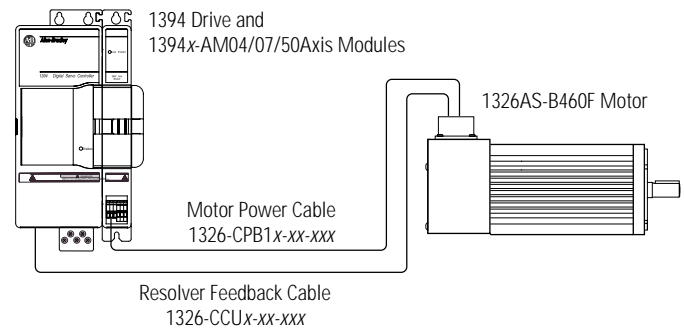
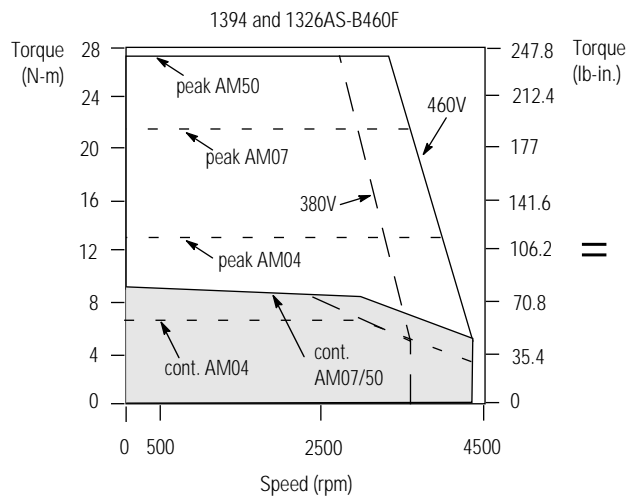
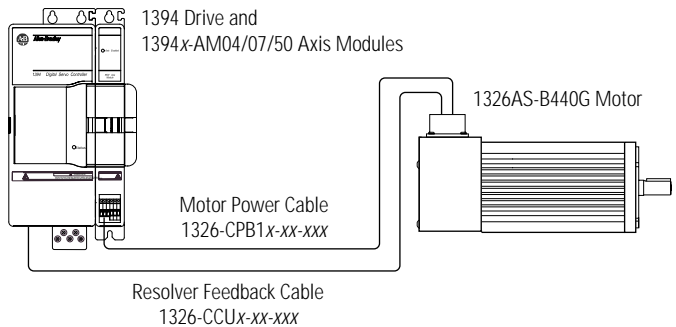
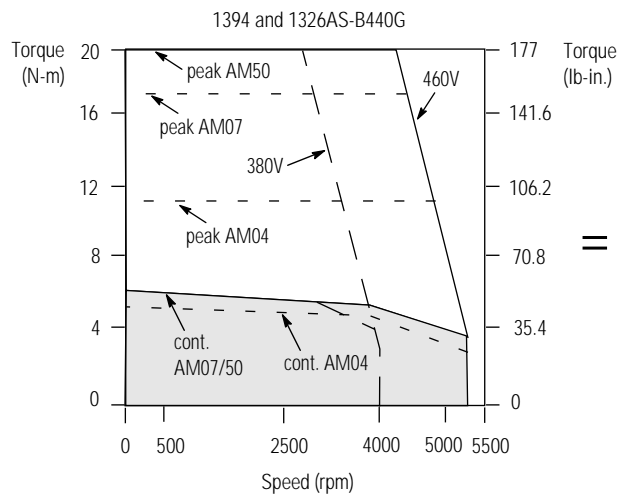
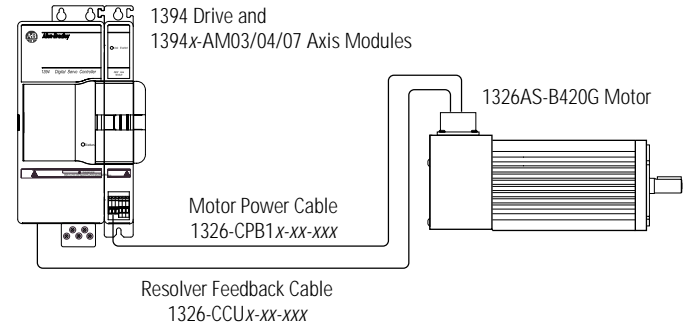
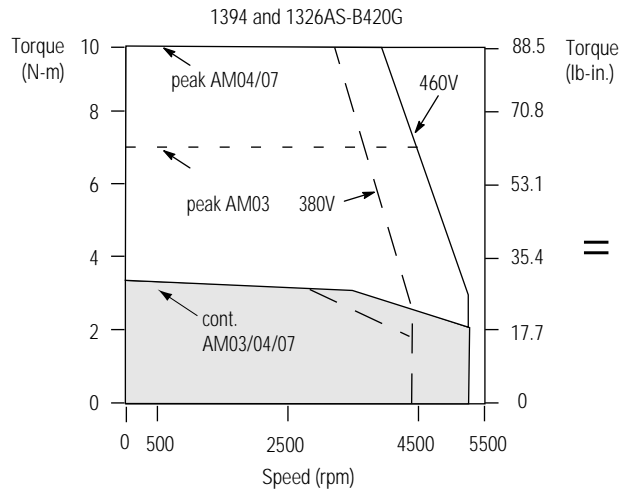
The motor was tested at a line voltage of 460V AC, in an environment where the ambient temperature was 40° C (104° F). The case temperature was approximately 100° C (212° F) with the motor windings at an 85° C (185° F) rise over ambient. Torque ratings were determined when the motor was mounted to a 304.8 mm x 304.8 mm x 25.4 mm (12 in. x 12 in. x 1 in.) steel mounting bracket. The motor contains a normally closed thermal switch that opens when the internal motor temperature reaches 140° C (284° F) $\pm 5^{\circ}$ C ($\pm 9^{\circ}$ F). The thermal switch has a maximum current rating of 2.5A at 250V AC. All values shown below have a tolerance of $\pm 10\%$.

IMPORTANT

Refer to the chapter *Motors* for system ratings for specific motor/amplifier combinations.



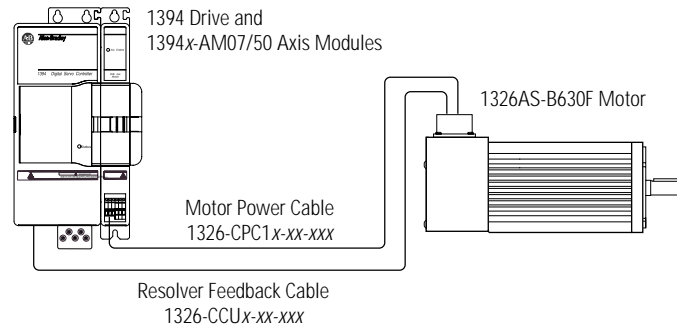
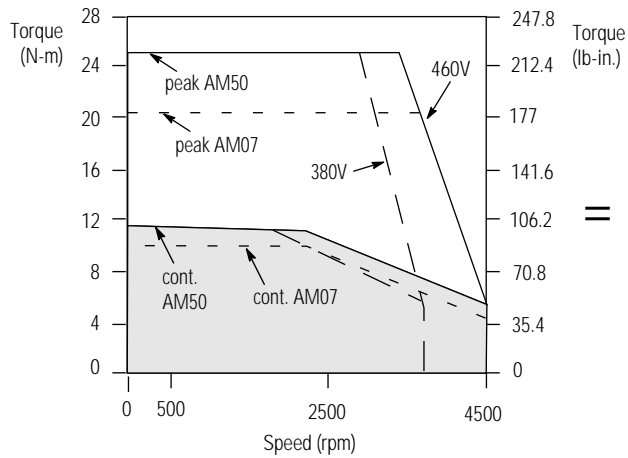
1394 Drive/Axis Modules with 1326AS Motors, Continued



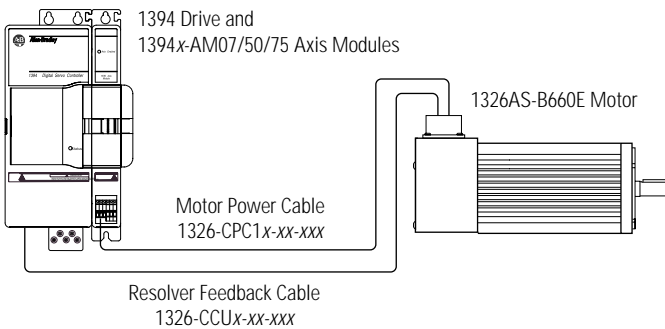
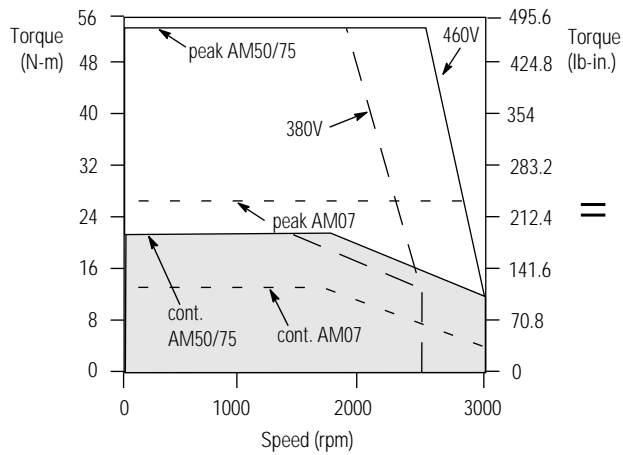
□ = Intermittent operating region
 ■ = Continuous operating region

1394 Drive/Axis Modules with 1326AS Motors, Continued

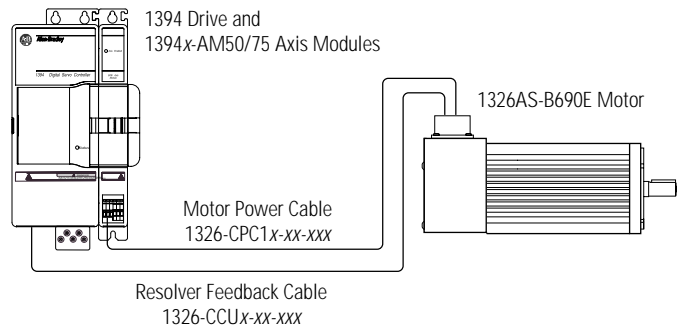
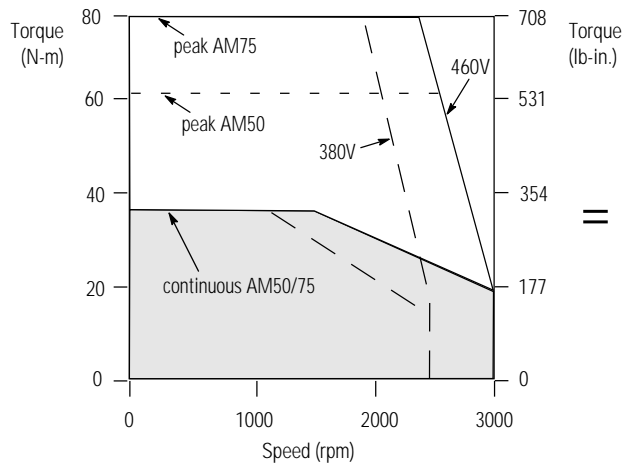
1394 and 1326AS-B630F



1394 and 1326AS-B660E

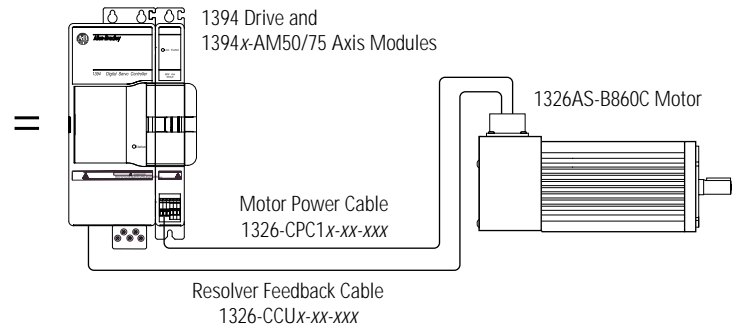
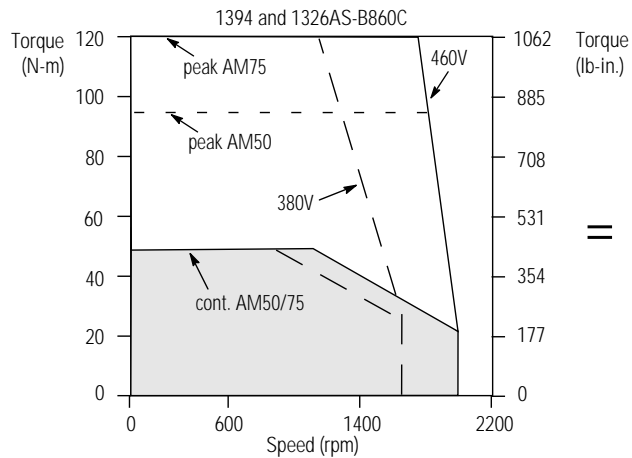
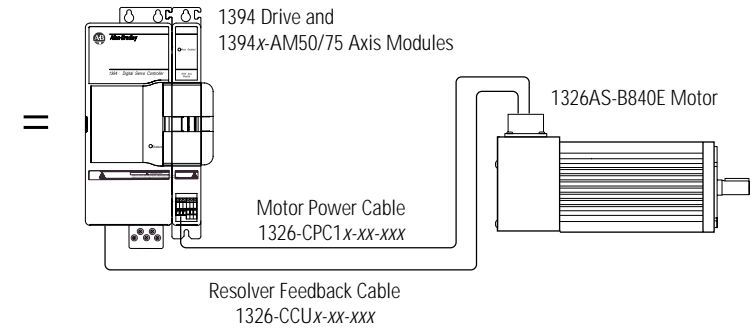
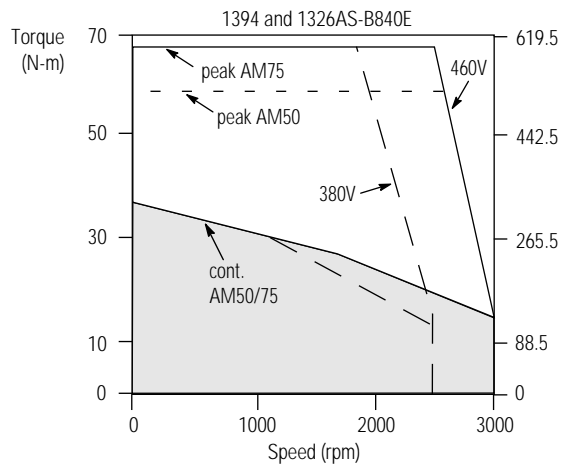


1394 and 1326AS-B690E



= Intermittent operating region
 = Continuous operating region

1394 Drive/Axis Modules with 1326AS Motors, Continued



□ = Intermittent operating region
 ■ = Continuous operating region

Motion Control Accessories

This chapter includes dimensions, specifications, and catalog numbers for the Bulletin 2098 Ultra Family and the Bulletin 1394 System Family accessories, as outlined in the tables below.

2098 Ultra Family	1394 System Family
Cables	System Module Cables
Connector Kits	AC Line Filters
Mating Connector Kits	Shunt Modules
Break Out Components	Motor Cables
AC Line Filters	Miscellaneous
Shunt Kits	

2098 Ultra Family Drive Systems

The following sections contain the dimensions, specifications, and catalog numbers, for the Ultra3000/5000 cables, shunt kits, AC line filters, and other accessory items.

Ultra Family Cable Connections

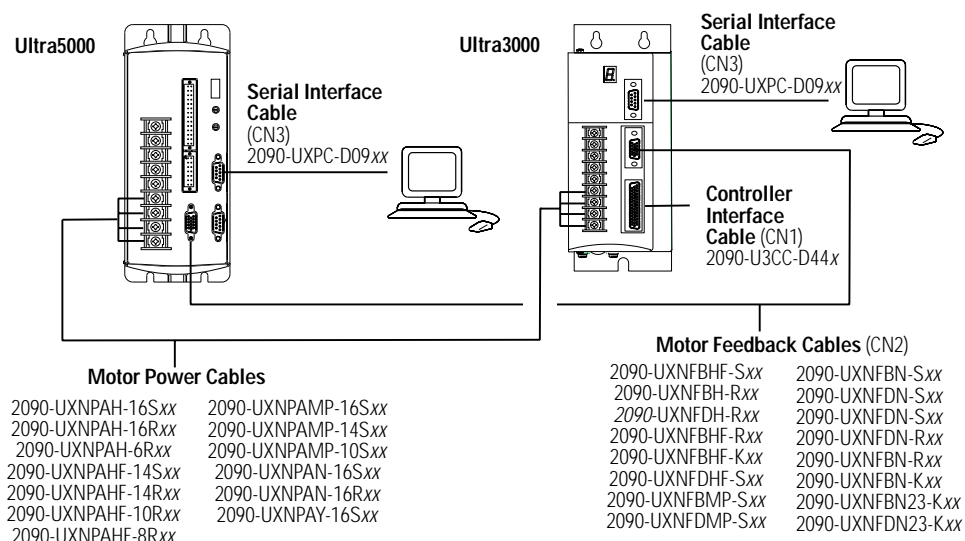
Motor power and feedback cables include integral molded, bayonet style, quick connect style, quick-release connectors that are compatible with Ultra3000/5000 drives.

Power connector cables have flying leads on the drive end and a straight connector that connects to F-, H-, MP-, N- and Y-Series servo motors. Standard feedback connector cables have an angled connector (45°) on the drive end and a straight connector that connects to F-, H-, MP-, N- and Y-Series servo motors. Optional feedback connector cables have a straight connector on the motor end and flying leads that lead to a terminal strip and a connector on the drive end.

Serial interface cables have an angled connector (45°) on the drive end and a straight connector to a PC. The Ultra3000 control interface cable has an angled connector (45°) on the drive end with no connector (flying leads) on the other.

Figure 8.1 provides motor power, feedback, and interface connections for the Ultra3000/5000 drive systems and motors.

Figure 8.1
F-, H-, MP-, N-, and Y-Series Servo Motor and Ultra3000/5000 Drive Connections



Ultra Family Motor Cable Combinations

The following tables contain the motor/cable combinations for each of the Ultra Family motors.

Motor Series	Power Cable
F	2090-UXNPAHF-10Sxx ¹ 2090-UXNPAHF-14Sxx ²
H	2090-UXNPAHF-10Sxx ¹ 2090-UXNPAHF-10Rxx ¹ 2090-UXNPAHF-14Sxx ² 2090-UXNPAHF-14Rxx ² 2090-UXNPAH-16Sxx ³ 2090-UXNPAH-16Rxx ³ 2090-UXNPAH-6Rxx ⁵ 2090-UXNPAHF-8Rxx ⁵
MP	2090-UXNPAMP-10Sxx ¹ 2090-UXNPAMP-14Sxx ⁴ 2090-UXNPAMP-16Sxx ³
N	2090-UXNPAN-16Sxx ³ 2090-UXNPAN-16Rxx ³
Y	2090-UXNPAY-16Sxx ³

Motor Series	Feedback Cable
F	2090-UXNFBHF-Sxx 2090-UXNFBH-Rxx 2090-UXNFDHF-Sxx 2090-UXNFDH-Rxx
H	2090-UXNFBHF-Sxx 2090-UXNFBHF-Rxx 2090-UXNFBHF-Kxx 2090-UXNFDHF-Sxx
MP	2090-UXNFBMP-Sxx 2090-UXNFDMP-Sxx
N	2090-UXNFBN-Sxx 2090-UXNFBN-Rxx 2090-UXNFBN-Kxx 2090-UXNFDN-Sxx 2090-UXNFDN-Rxx 2090-UXNFBN23-Kxx 2090-UXNFDN23-Kxx
Y	2090-UXNFBY-Sxx 2090-UXNFDY-Sxx

¹ Cable models are designed for 7.5 kW drives only.

² Cable models are designed for 2 or 3 kW drives only.

³ Cable models are designed for 500W, 1 kW or 2 kW drives only.

⁴ Cable models are designed for 3 kW drives only.

⁵ Cable models are designed for 15 kW Ultra3000 drives only.

The following sections contain the dimensions for Ultra Family motor power, motor feedback, and interface cables.

Dimensions are in millimeters (inches).

101.6 (4)

91.7 (3.61)

Bend Radius

66.29 (2.61)

12.7 (0.51)¹

50.8 (2)¹

25.4 (1)¹

6.35 (0.25)¹

133.35 (5.25)

184.15 (7.25)²

10.16 (0.4)¹

20.32 (0.8)¹

30.48 (1.2)

9.2 mm (0.36 in.) diameter

9.4 mm (0.37 in.) maximum diameter

1 Tolerance is +3.05 mm (+0.12 in.).

2 Tolerance is ±6.35 mm (±0.25 in.).

Wire Labels: Brown, Black, Blue, Green/Yellow, U, V, W, X

Technical drawing of a cable assembly with dimensions in millimeters (mm) and inches (in.).

Dimensions are in millimeters (inches).

Top View:

- Overall length: 114.3 (4.5)
- Distance from connector to bend: 98.8 (3.89)
- Bend Radius: 98.8 (3.89)
- Distance from bend to end: 30.8 (12)
- Distance from bend to end (with tolerance): 12.7 (0.5)¹
- Distance from bend to end (with tolerance): 50.8 (2)¹
- Distance from bend to end (with tolerance): 25.4 (1)¹
- Distance from bend to end (with tolerance): 6.35 (0.25)¹
- Distance from bend to end (with tolerance): 133.35 (5.25)¹
- Distance from bend to end (with tolerance): 184.15 (7.25)²
- Distance from bend to end (with tolerance): 20.32 (0.8)¹
- Distance from bend to end (with tolerance): 30.48 (1.2)¹
- Distance from bend to end (with tolerance): 10.16 (0.4)¹

Bottom View:

- Overall length: 114.3 (4.5)
- Distance from connector to bend: 98.8 (3.89)
- Bend Radius: 98.8 (3.89)
- Distance from bend to end: 30.8 (12)
- Distance from bend to end (with tolerance): 12.7 (0.5)¹
- Distance from bend to end (with tolerance): 50.8 (2)¹
- Distance from bend to end (with tolerance): 25.4 (1)¹
- Distance from bend to end (with tolerance): 6.35 (0.25)¹
- Distance from bend to end (with tolerance): 133.35 (5.25)¹
- Distance from bend to end (with tolerance): 184.15 (7.25)²
- Distance from bend to end (with tolerance): 20.32 (0.8)¹
- Distance from bend to end (with tolerance): 30.48 (1.2)¹
- Distance from bend to end (with tolerance): 10.16 (0.4)¹

Notes:

- ¹ Tolerance is +3.05 mm (+0.12 in.).
- ² Tolerance is ±6.35 mm (±0.25 in.).

Dimensions are in millimeters (inches).

133.35 (5.25)

91.7 (3.61)

Bend Radius

59.7 (2.35)

12.7 (0.5)¹

50.8 (2)¹

25.4 (1)¹

Brown

Black

Blue

Green/Yellow

White

10.16 (0.4)¹

20.32 (0.8)¹

30.48 (0.5)¹

6.35 (0.25)¹

133.35 (5.25)¹

184.15 (7.25)²

42.672 mm (1.68 in.) diameter

9.17 mm (0.36 in.) diameter

9.68 mm (0.38 in.) maximum diameter

¹ Tolerance is +3.05 mm (+0.12 in.).

² Tolerance is ±6.35 mm (±0.25 in.).

Figure 8.5
MP-Series Motor Power Cable Dimensions (2090-UXNPAMP-16Sxx, -14Sxx and -10Sxx)

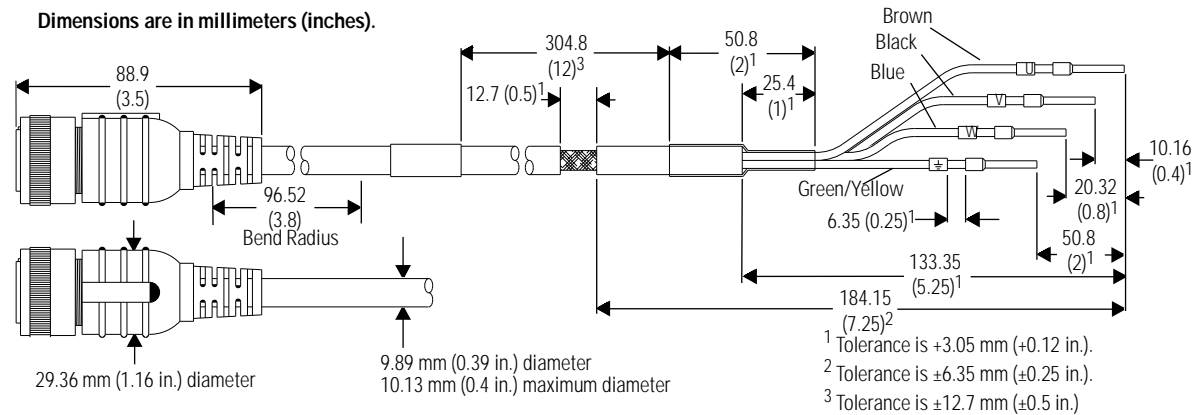


Figure 8.6
N-Series Motor Power Cable Dimensions (2090-UXNPAN-16Sxx)

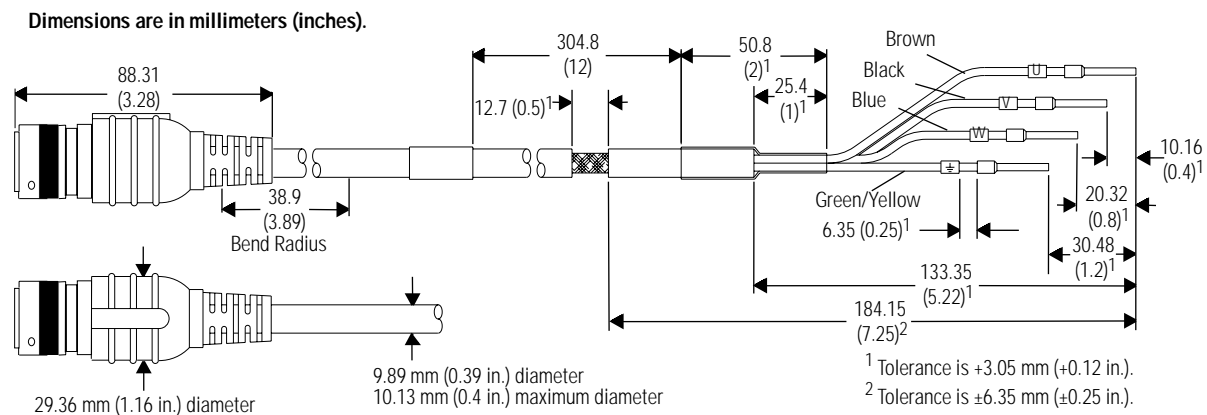
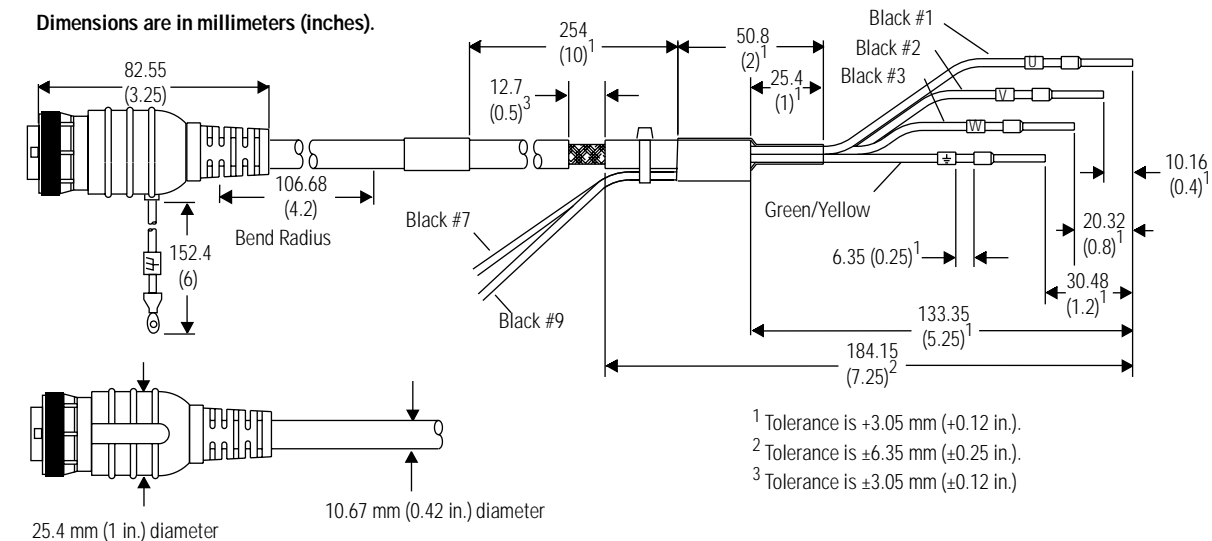


Figure 8.7
Y-Series Motor Power Cable Dimensions (2090-UXNPAY-16Sxx)



Motor Feedback Cable Dimensions

Figure 8.8
H/F-Series Motor Feedback Cable Dimensions (2090-UXNFBHF-Sxx and 2090-UXNFDHF-Sxx)

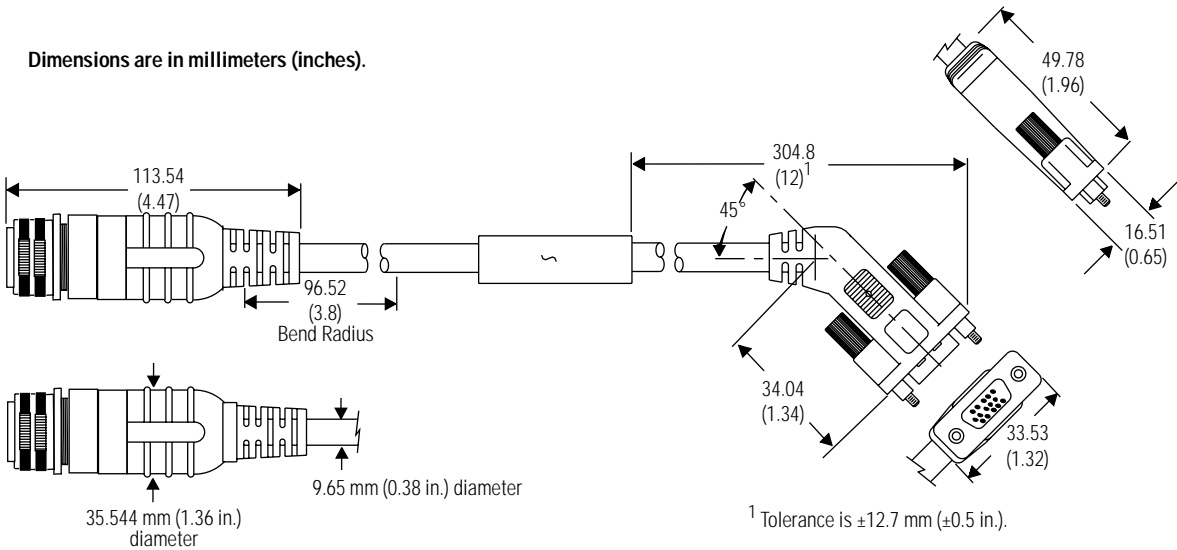


Figure 8.9
MP-Series Motor Feedback Cable Dimensions (2090-UXNFBMP-Sxx and 2090-UXNFDMP-Sxx)

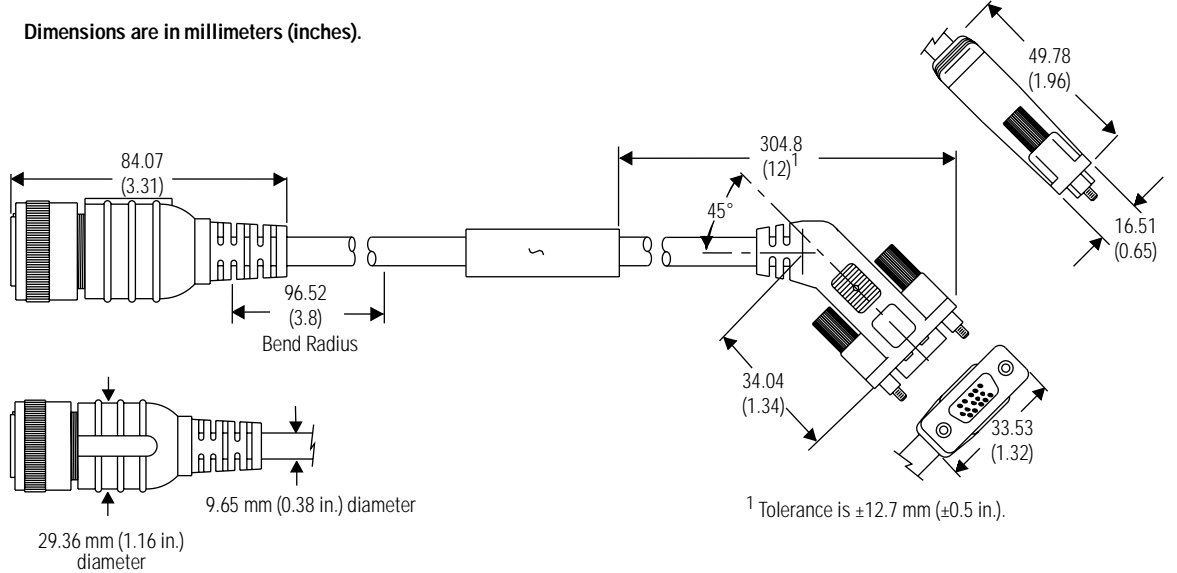


Figure 8.10
N-Series Motor Feedback Cable Dimensions (2090-UXNFBN-Sxx and 2090-UXNFDN-Sxx)

Dimensions are in millimeters (inches).

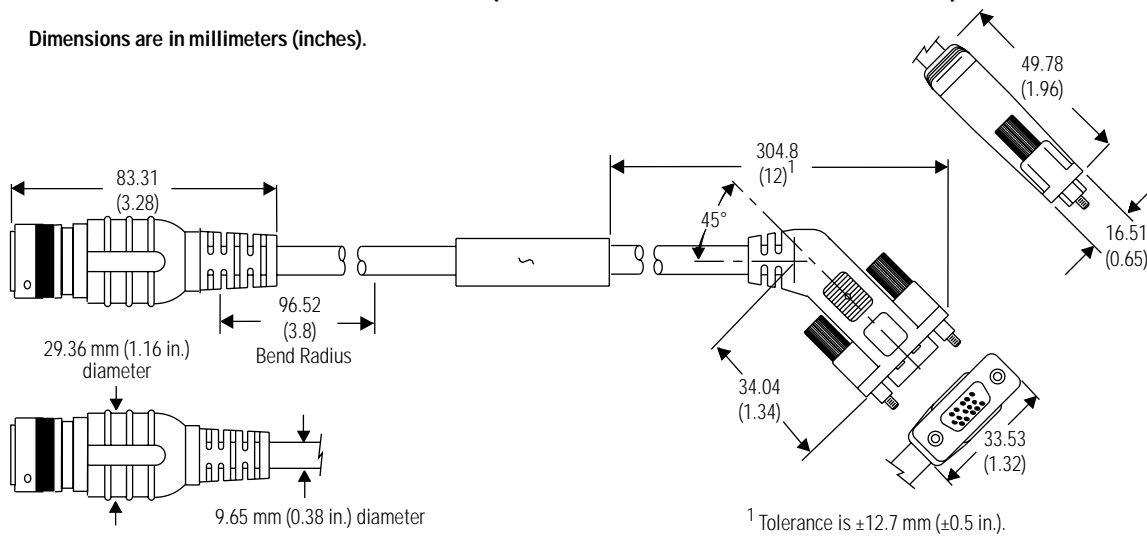
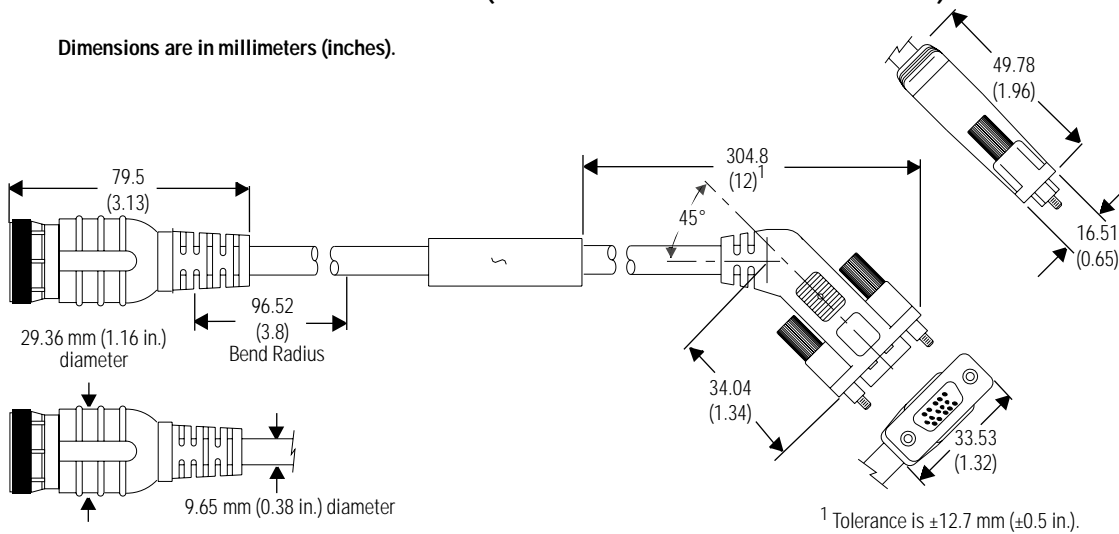


Figure 8.11
Y-Series Motor Feedback Cable Dimensions (2090-UXNFBY-Sxx and 2090-UXNFDY-Sxx)

Dimensions are in millimeters (inches).



Interface Cable Dimensions

Figure 8.12
Serial Interface Cable Dimensions (2090-UXPC-D09xx)

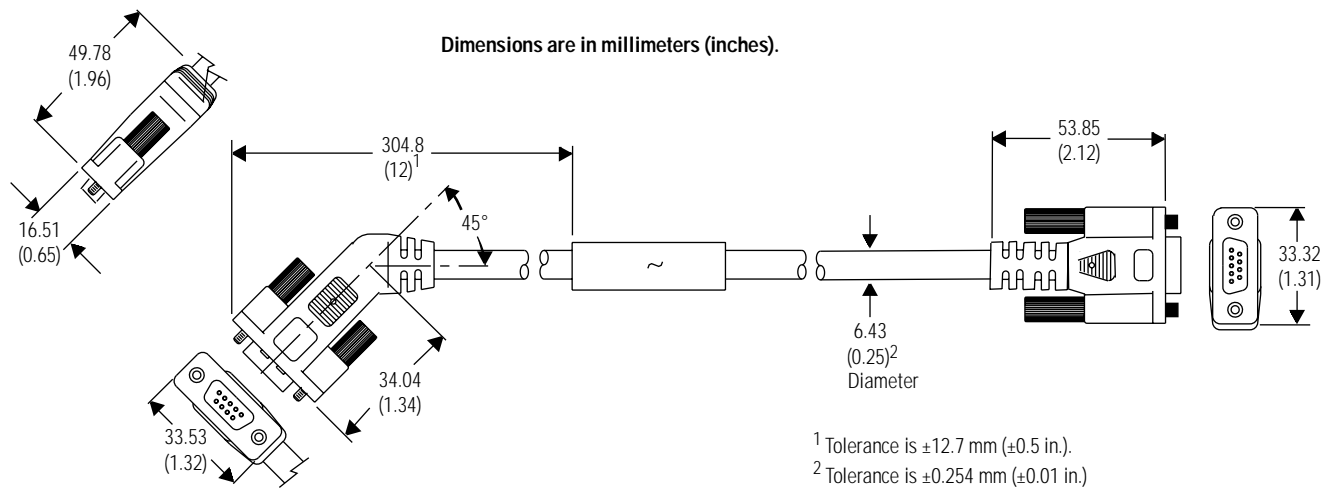


Figure 8.13
Control Interface Cable Dimensions (2090-U3CC-D44xx)

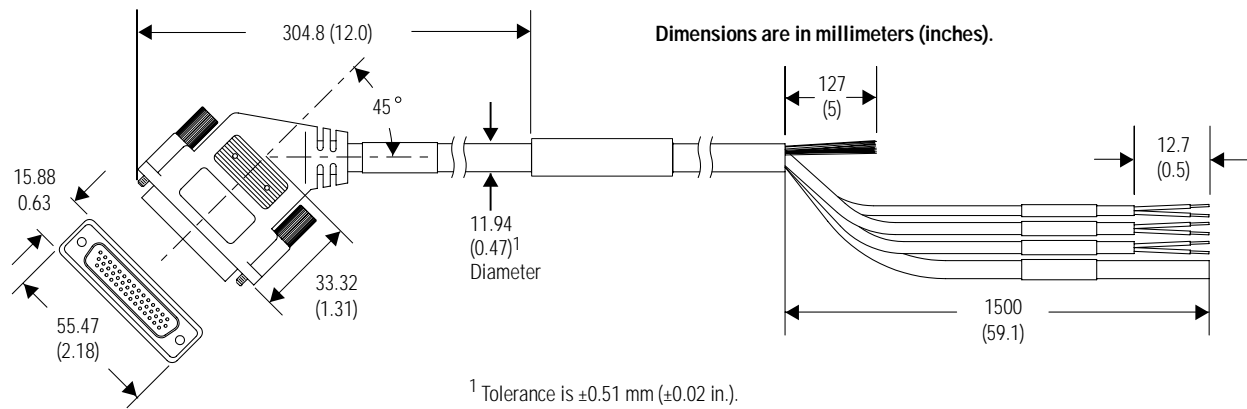


Figure 8.14
ControlLogix 1756-M02AE Card Encoder Cable Dimensions (2090-U3AE-D44.xx)

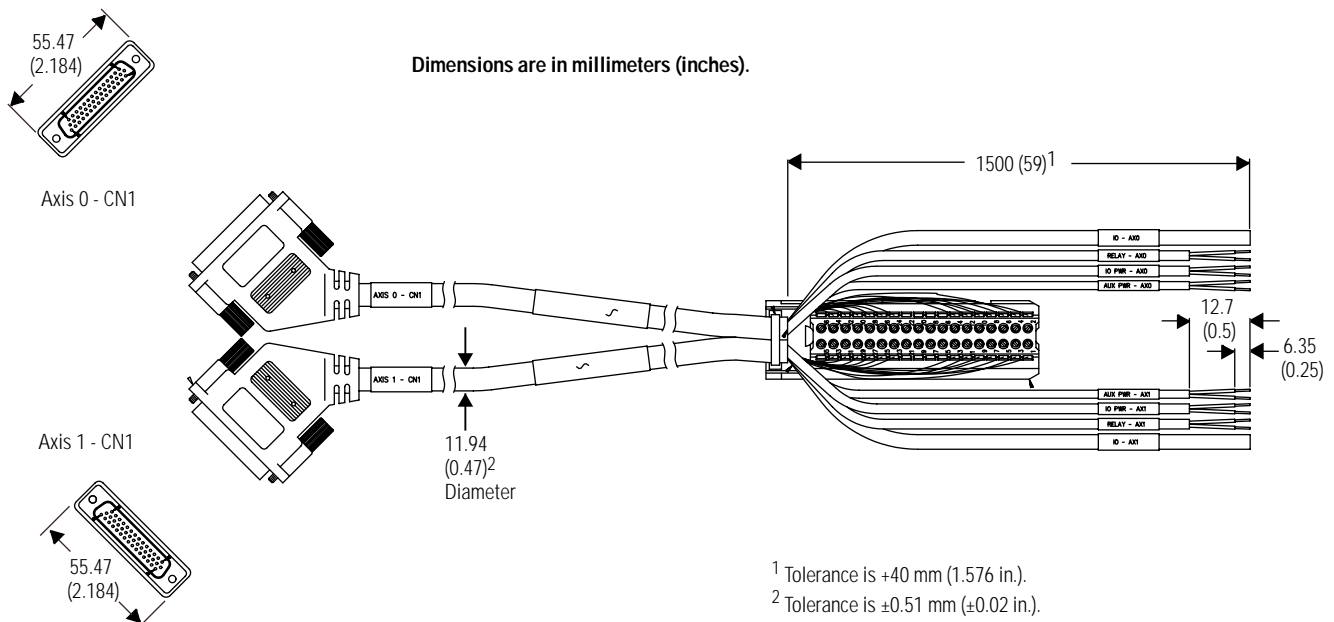
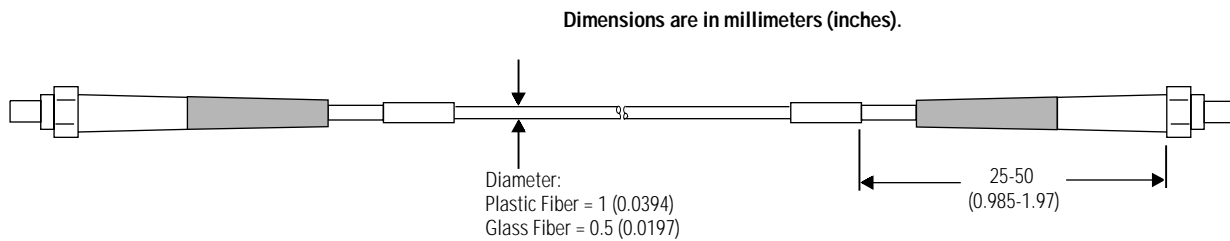


Figure 8.15
Fiber-Optic SERCOS Interface Cable Dimensions (2090-SCxxx-x-x)



Ultra Family Cable Specifications

The following sections contain the specifications for Ultra Family motor power, motor feedback and control interface cables.

Motor Power Cables

Power Cables	Specifications			
	Rating ° C (° F), Volts	Shield Coverage	Shield Material	Jacket Material
2090-UXNPAY-16Sxx	90° C (194° F), 600V	85%, Braided	Braided	Thermoplastic
2090-UXNPAH-16Sxx				
2090-UXNPAHF-14Sxx				
2090-UXNPAHF-10Sxx				
2090-UXNPAN-16Sxx				
2090-UXNPAMP-14Sxx	105° C (221° F), 600V			Elexar
2090-UXNPAMP-16Sxx				

Motor Feedback Cables

Feedback Cables	Specifications			
	Rating ° C (° F), Volts	Shield Coverage	Shield Material	Jacket Material
2090-UXNFxHF-Sxx 2090-UXNFxN-Sxx 2090-UXNFxY-Sxx	80° C (176° F), 30V	100% Polyester (with 85% braid overshield)	Polyester	Thermoplastic
2090-UXNFxMP-Sxx	105° C (221° F), 300V	100% Mylar (with 85% braid overshield)	Mylar	Elexar

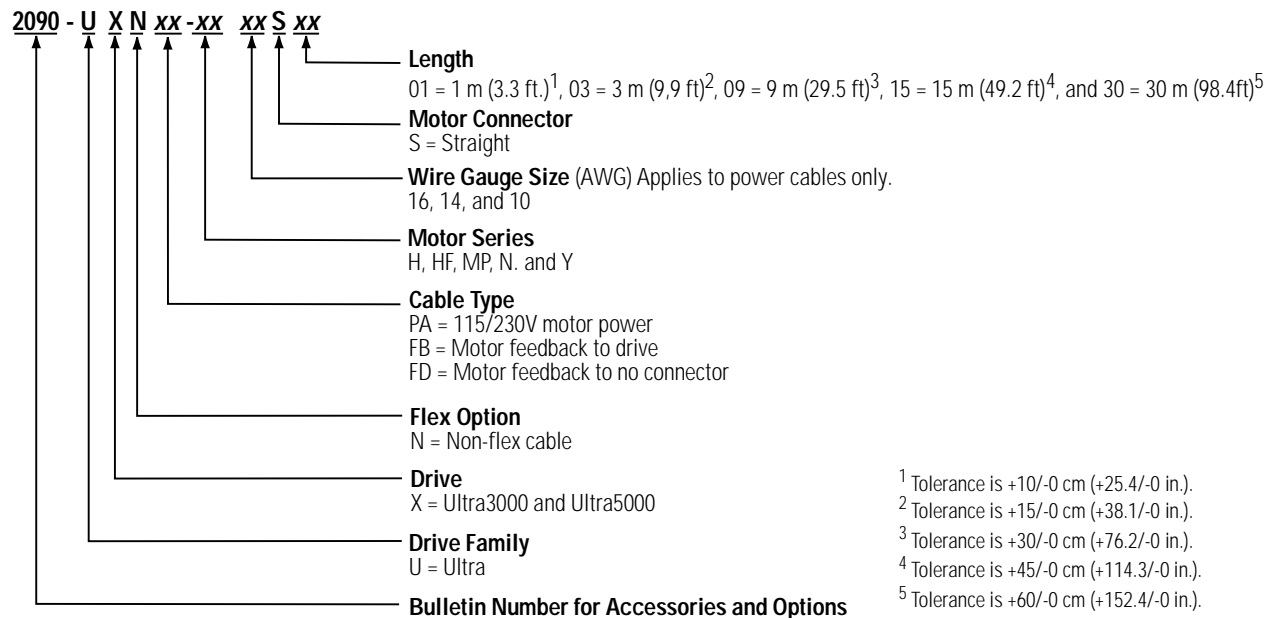
Interface Cables

Interface Cable	Specifications			
	Rating ° C (° F), Volts	Shield Coverage	Shield Material	Jacket Material
2090-UXPC-D09xx	80° C (176° F), 30V	100% Polyester	Polyester	Thermoplastic
2090-U3CC-D44xx	80° C (176° F), 30V	100% Aluminum Foil	Aluminum Foil	
2090-U3AE-D44xx				
2090-SCxxx-x-x	85° C (185° F), 170 decibels at 650 nanometers	Quartz Fiber or Nylon	Quartz Fiber or Nylon	Kevlar PVC

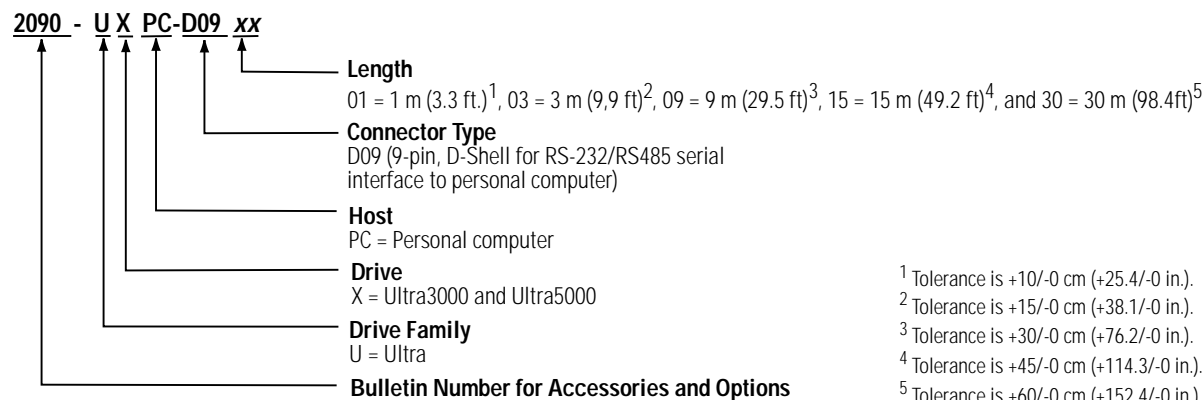
Ultra Family Cable Catalog Numbers

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering charts below to understand the configuration of your cables. For questions regarding product availability, contact your Allen-Bradley distributor.

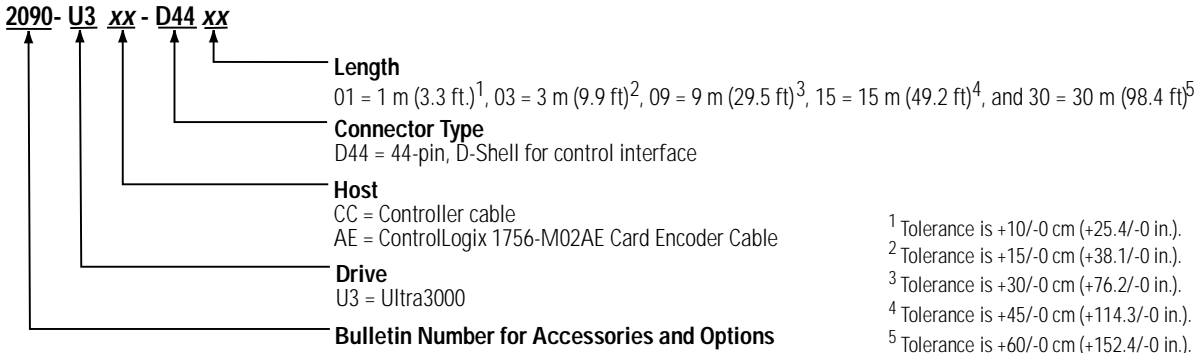
Motor Power and Feedback Cables



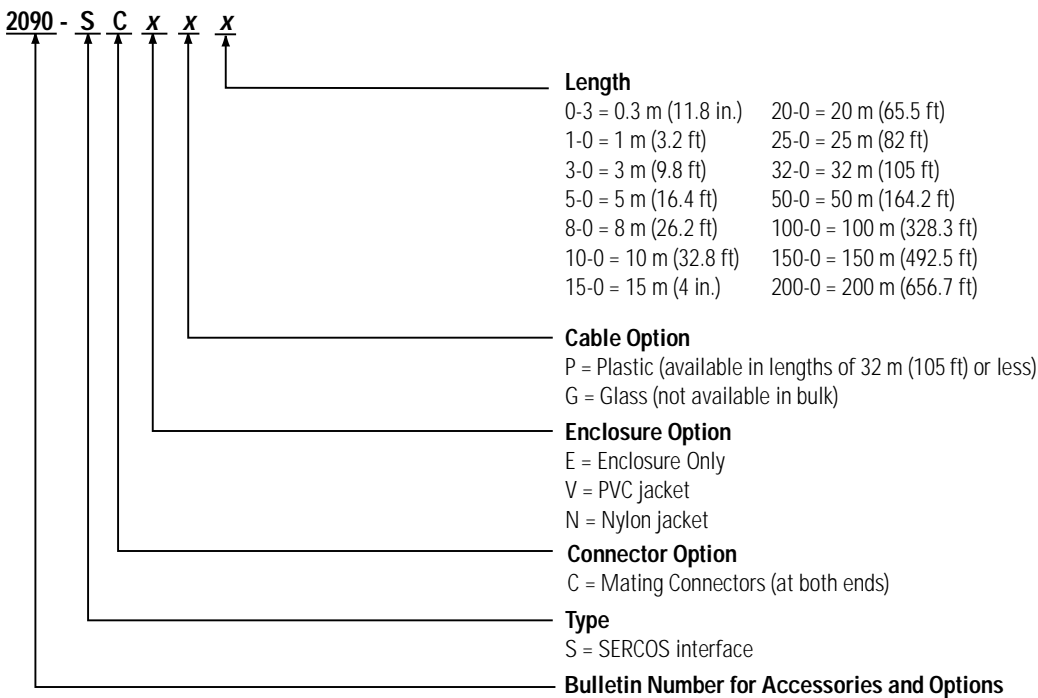
Serial Interface Cables



Control Interface Cables



SERCOS Interface Fiber-Optic Cables



Note: Lengths of 1 m (3.2 ft) to 32 m (105 ft) are available in plastic or glass. Lengths of 50 m (164.2 ft) to 200 m (656.7 ft) are available in glass only.
 Note: The configuration options are limited to the following combinations: -SCBP, -SCVP, -SCNP, and -SCVG.

Ultra Family Cable Connection and Functionality Charts

The following section contains the Ultra3000/5000 functionality charts for motor power, motor feedback and interface cables.

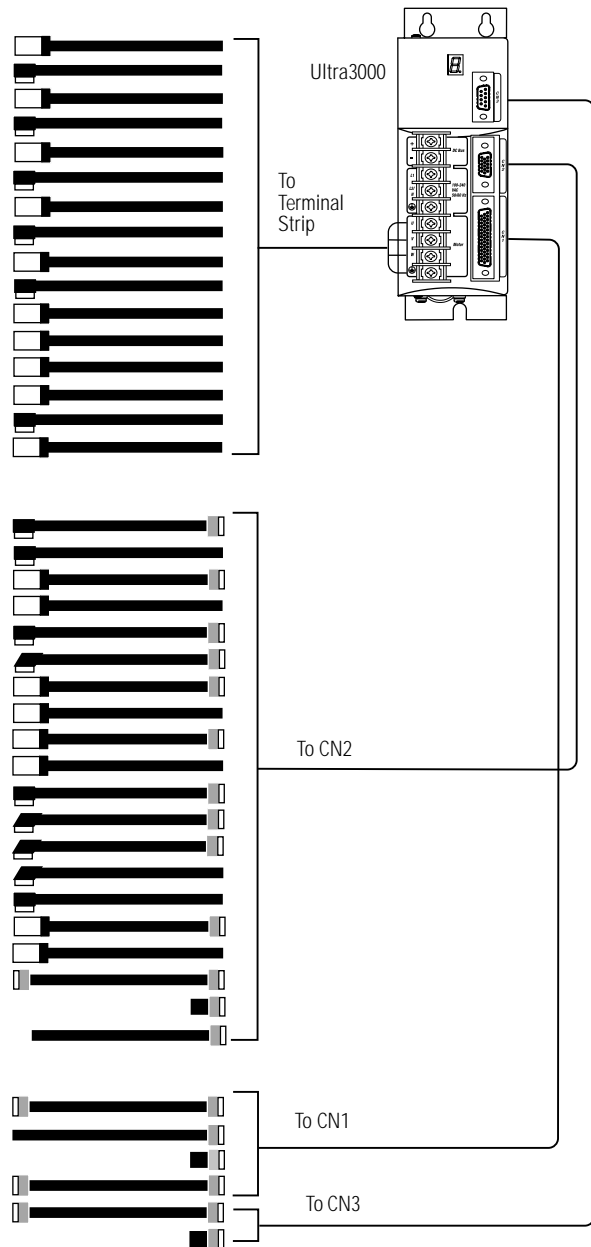
Figure 8.16
Ultra3000 Cable Connection and Functionality Chart

Motor Power Cables

500W, 1 kW, 2 kW Ultra3000 to H-Series Motors
 500W, 1 kW, 2 kW Ultra3000 to H-Series Motors
 15 kW Ultra3000 to H-Series Motors
 15 kW Ultra3000 to H-Series Motors
 2 or 3 kW Ultra3000 to H and F-Series Motors
 2 or 3 kW Ultra3000 to H and F-Series Motors
 7.5 kW Ultra3000 to H and F-Series Motors
 7.5 kW Ultra3000 to H and F-Series Motors
 15 kW Ultra3000 to H and F-Series Motors
 15 kW Ultra3000 to H and F-Series Motors
 500W, 1 kW, 2 kW Ultra3000 to MP-Series Motors
 2 or 3 kW Ultra3000 to MP-Series Motors
 7.5 kW Ultra3000 to MP-Series Motors
 500W, 1 kW, 2 kW Ultra3000 to N-Series Motors
 500W, 1 kW, 2 kW Ultra3000 to N-Series Motors
 500W, 1 kW, 2 kW Ultra3000 to Y-Series Motors

Catalog Number

2090-UXNPAH-16Sxx
 2090-UXNPAH-16Rxx
 2090-UXNPAH-6Sxx
 2090-UXNPAH-6Rxx
 2090-UXNPAHF-14Sxx
 2090-UXNPAHF-14Rxx
 2090-UXNPAHF-10Sxx
 2090-UXNPAHF-10Rxx
 2090-UXNPAHF-8Sxx
 2090-UXNPAHF-8Rxx
 2090-UXNPAMP-16Sxx
 2090-UXNPAMP-14Sxx
 2090-UXNPAMP-10Sxx
 2090-UXNPAN-16Sxx
 2090-UXNPAN-16Rxx
 2090-UXNPAY-16Sxx



Feedback Cables

Ultra3000 CN2 port to H-Series Motors, RA
 Flying Leads on drive-end to H-Series Motor, RA
 Ultra3000 CN2 port to H and F-Series Motors
 Flying Leads on drive-end to H and F-Series Motor
 Ultra3000 CN2 port to H and F-Series Motors, RA
 Ultra3000 CN2 port to H and F-Series Motors, RA, skewed
 Ultra3000 CN2 port to MP-Series Motors
 Flying Leads on drive-end to MP-Series Motor
 Ultra3000 CN2 port to N-Series Motors
 Flying leads on drive-end to N-Series Motors
 Ultra3000 CN2 port to N-Series Motors, RA
 Flying leads on drive-end to N-Series Motors, RA
 Ultra3000 CN2 port to N-Series Motors, RA, skewed
 Ultra3000 CN2 port to N-Series Motors, RA, skewed
 Flying leads on drive-end to N-Series Motors, RA, skewed
 Ultra3000 CN2 port to Y-Series Motors
 Flying Leads on drive-end to Y-Series Motor
 CN2 Break Out Board Kit
 CN2 drive mounted Break Out Board
 Drive Feedback Cable (CN2) to flying leads, straight

Catalog Number

2090-UXNFBH-Rxx
 2090-UXNFDH-Rxx
 2090-UXNFBHF-Sxx
 2090-UXNFDHF-Sxx
 2090-UXNFBHF-Rxx
 2090-UXNFBHF-Kxx
 2090-UXNFBMP-Sxx
 2090-UXNFDMP-Sxx
 2090-UXNFBN-Sxx
 2090-UXNFDN-Sxx
 2090-UXNFBN-Rxx
 2090-UXNFDN-Rxx
 2090-UXNFBN-Kxx
 2090-UXNFDN23-Kxx
 2090-UXNFBY-Sxx
 2090-UXNFDY-Sxx
 2090-UXBK-D15xx
 2090-UXBB-DM15
 2090-UXNFM-Sxx

Interface Cables

Ultra3000 CN1 Break Out Board Kit
 Ultra3000 CN1 port to no connector
 Ultra3000 CN1 drive mounted Break Out Board
 Ultra3000 CN1 port to ControlLogix servo module
 Ultra3000 CN3 serial port to personal computer
 Ultra3000 CN3 drive mounted Break Out Board

Catalog Number

2090-U3BK-D44xx
 2090-U3CC-D44xx
 2090-U3BB-DM44
 2090-U3AE-D44xx
 2090-UXPC-D09xx
 2090-UXBB-DM09

Length of cable xx is in meters; 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Figure 8.17
Ultra5000 Cable Connection and Functionality Chart

Cable Description

Cable Catalog Number

Motor Power Cables

500W, 1 kW, 2 kW Ultra5000 to H-Series Motors
 500W, 1 kW, 2 kW Ultra5000 to H-Series Motors
 2 or 3 kW Ultra5000 to H and F-Series Motors
 7.5 kW Ultra5000 to H and F-Series Motors
 500W, 1 kW, 2 kW Ultra5000 to MP-Series Motors
 2 or 3 kW Ultra5000 to MP-Series Motors
 7.5 kW Ultra5000 to MP-Series Motors
 500W, 1 kW, 2 kW Ultra5000 to N-Series Motors
 500W, 1 kW, 2 kW Ultra5000 to N-Series Motors
 500W, 1 kW, 2 kW Ultra5000 to Y-Series Motors

2090-UXNPAH-16Sxx
 2090-UXNPAH-16Rxx
 2090-UXNPAHF-14Sxx
 2090-UXNPAHF-10Sxx
 2090-UXNPAMP-16Sxx
 2090-UXNPAMP-14Sxx
 2090-UXNPAMP-10Sxx
 2090-UXNPAN-16Sxx
 2090-UXNPAN-16Rxx
 2090-UXNPAY-16Sxx

Feedback Cables

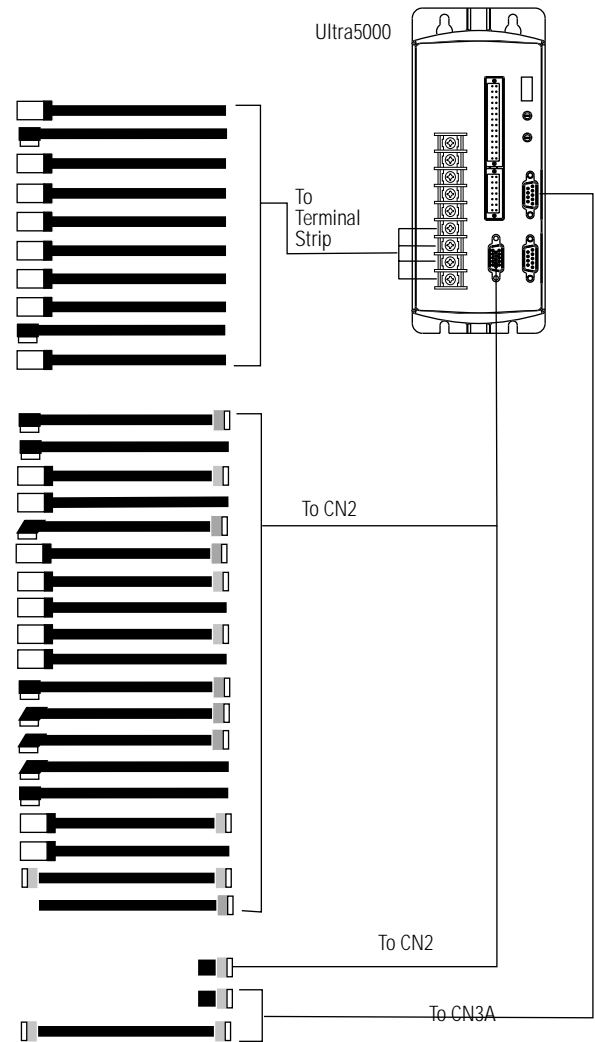
Ultra5000 CN2 port to H-Series Motors, RA
 Flying Leads on drive-end to H-Series Motor, RA
 Ultra5000 CN2 port to H and F-Series Motors
 Flying Leads on drive-end to H and F-Series Motor
 Ultra5000 CN2 port to H and F-Series Motors, RA
 Ultra5000 CN2 port to H and F-Series Motors, RA, skewed
 Ultra5000 CN2 port to MP-Series Motors
 Flying Leads on drive-end to MP-Series Motor
 Ultra5000 CN2 port to N-Series Motors
 Flying leads on drive-end to N-Series Motors
 Ultra5000 CN2 port to N-Series Motors, RA
 Flying leads on drive-end to N-Series Motors, RA
 Ultra5000 CN2 port to N-Series Motors, RA, skewed
 Ultra5000 CN2 port to N-Series Motors, RA, skewed
 Flying leads on drive-end to N-Series Motors, RA, skewed
 Ultra5000 CN2 port to Y-Series Motors
 Flying Leads on drive-end to Y-Series Motor
 CN2 Breakout Board Kit (see description on page 8-14)
 Drive Feedback Cable (CN2) to flying leads, straight

2090-UXNFBH-Rxx
 2090-UXNFDH-Rxx
 2090-UXNFBHF-Sxx
 2090-UXNFDHF-Sxx
 2090-UXNFBHF-Rxx
 2090-UXNFBHF-Kxx
 2090-UXNFBMP-Sxx
 2090-UXNFDMP-Sxx
 2090-UXNFBN-Sxx
 2090-UXNFDN-Sxx
 2090-UXNFBN-Rxx
 2090-UXNFDN-Rxx
 2090-UXNFBN-Kxx
 2090-UXNFBN23-Kxx
 2090-UXNFDN23-Kxx
 2090-UXNFBY-Sxx
 2090-UXNFDY-Sxx
 2090-UXBK-D15xx
 2090-UXNFM-Sxx

Interface Cables

Ultra5000 CN2 port drive mounted breakout board
 Ultra5000 CN3 port drive mounted breakout board
 Ultra5000 CN3A port to personal computer

2090-UXBB-DM15
 2090-UXBB-DM09
 2090-UXPC-D09xx



Length of cable xx is in meters; 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Break Out Board Components

The following sections contain descriptions, dimensions, specifications and catalog numbers for the Ultra3000/5000 break out board kits, cables, and boards.

Board Kits

Breakout board kits include the 2090-UxBB-Dxx DIN rail terminal block, 2090-UxBC-Dxxxx cable, and mounting hardware.

Kit	Description
2090-UXBK-D15xx	15-pin, high density D-shell for Ultra3000/5000, CN2 encoder interface
2090-U3BK-D44xx	44-pin, high density D-shell for Ultra3000, CN1 user I/O

Boards

Board	Description
2090-UXBB-D15	15-pin, high-density D-shell for Ultra3000/5000
2090-U3BB-D44	44-pin, high density D-shell for Ultra3000
2090-UXBB-DM09	9-pin, drive-mounted breakout board for CN3 connector and Ultra3000/5000
2090-UXBB-DM15	15-pin, drive-mounted breakout board for CN2 connector and Ultra3000/5000
2090-U3BB-DM44	44-pin, drive-mounted breakout board for CN1 connector and Ultra3000

Board Dimensions

Figure 8.18
15-Pin Break Out Board Dimensions (2090-UXBB-D15)

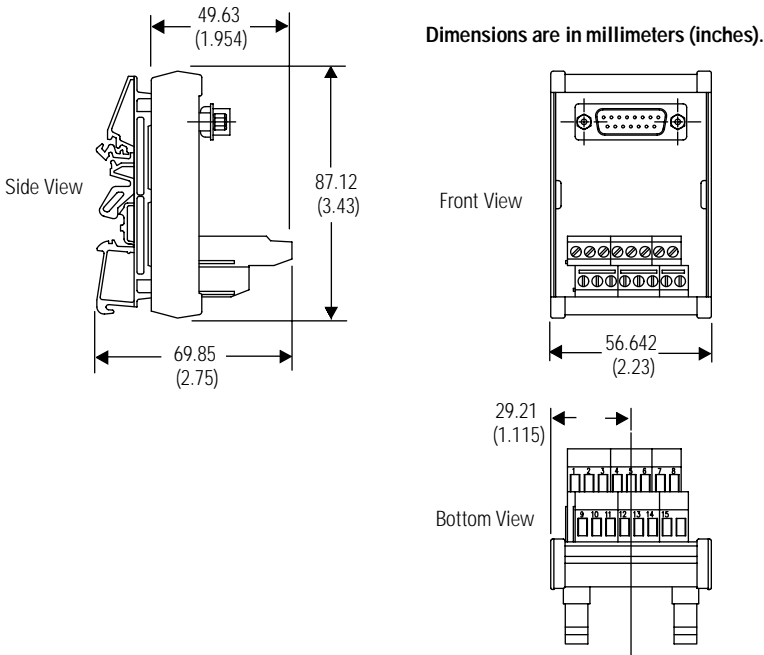


Figure 8.19
44-Pin Break Out Board Dimensions (2090-U3BB-D44)

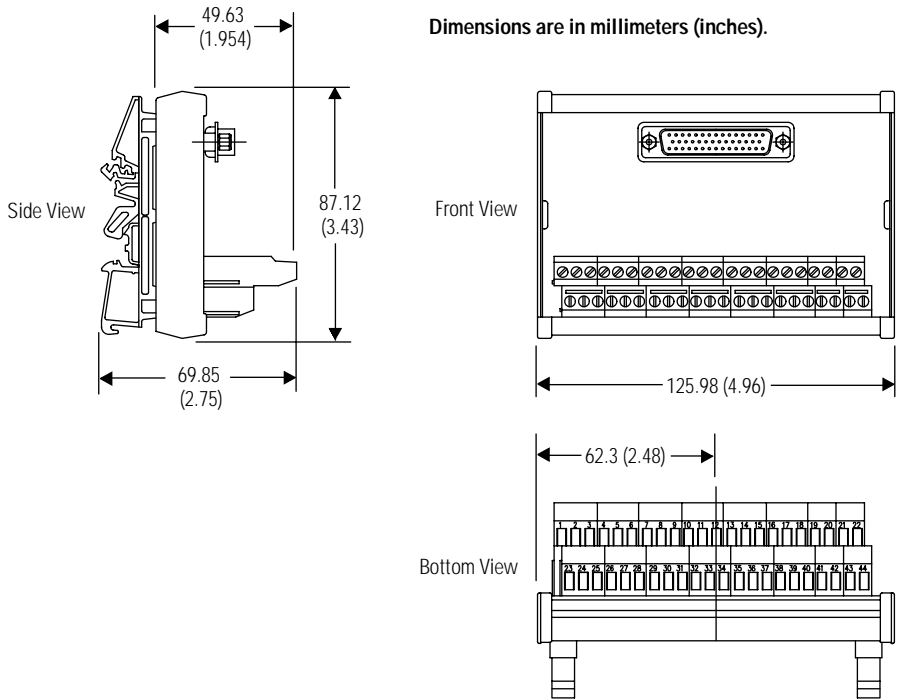


Figure 8.20
9-Pin Drive-Mounted Breakout Board Dimensions (2090-UXBB-DM09)

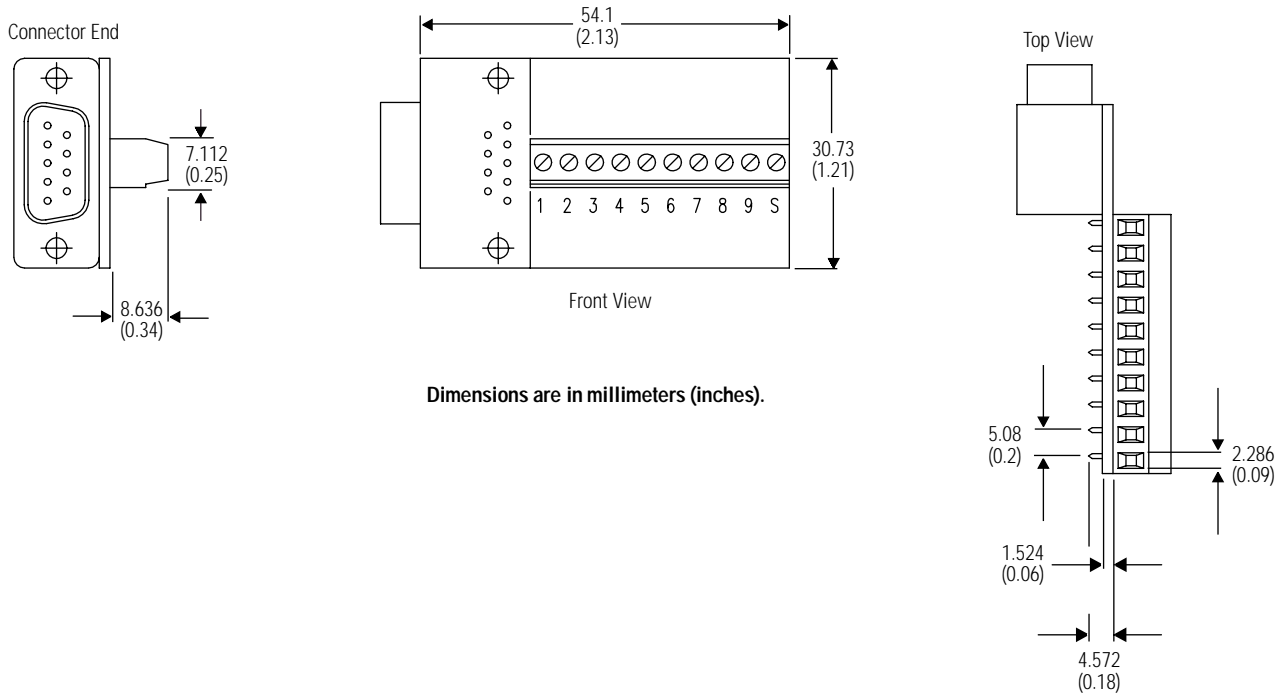


Figure 8.21
15-pin Drive-Mounted Breakout Board Dimensions (2090-UXBB-DM15)

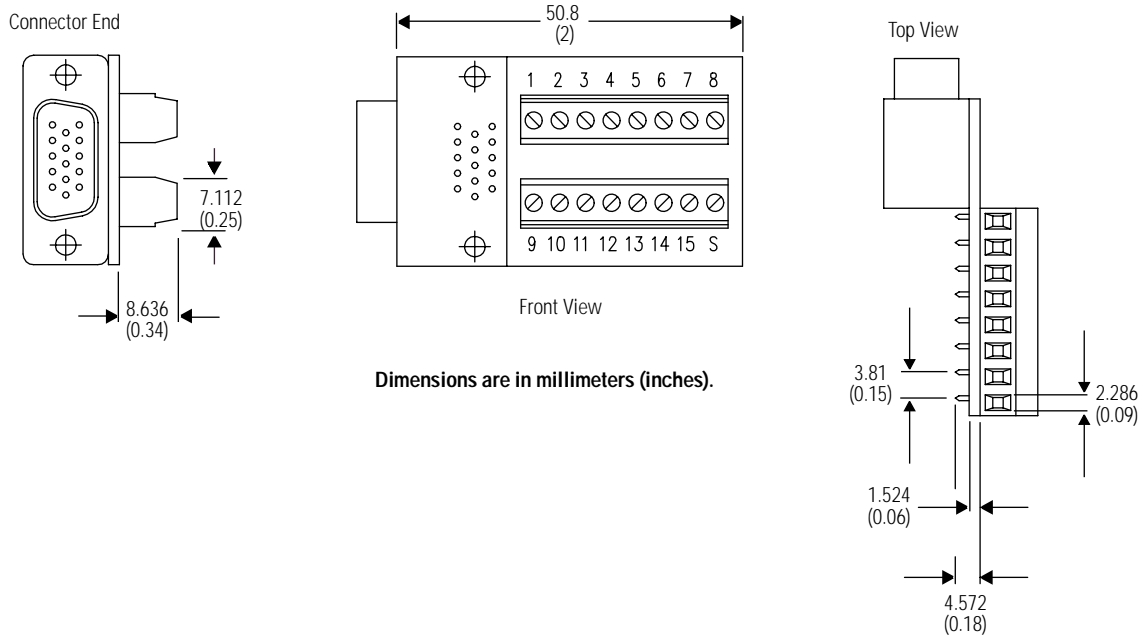
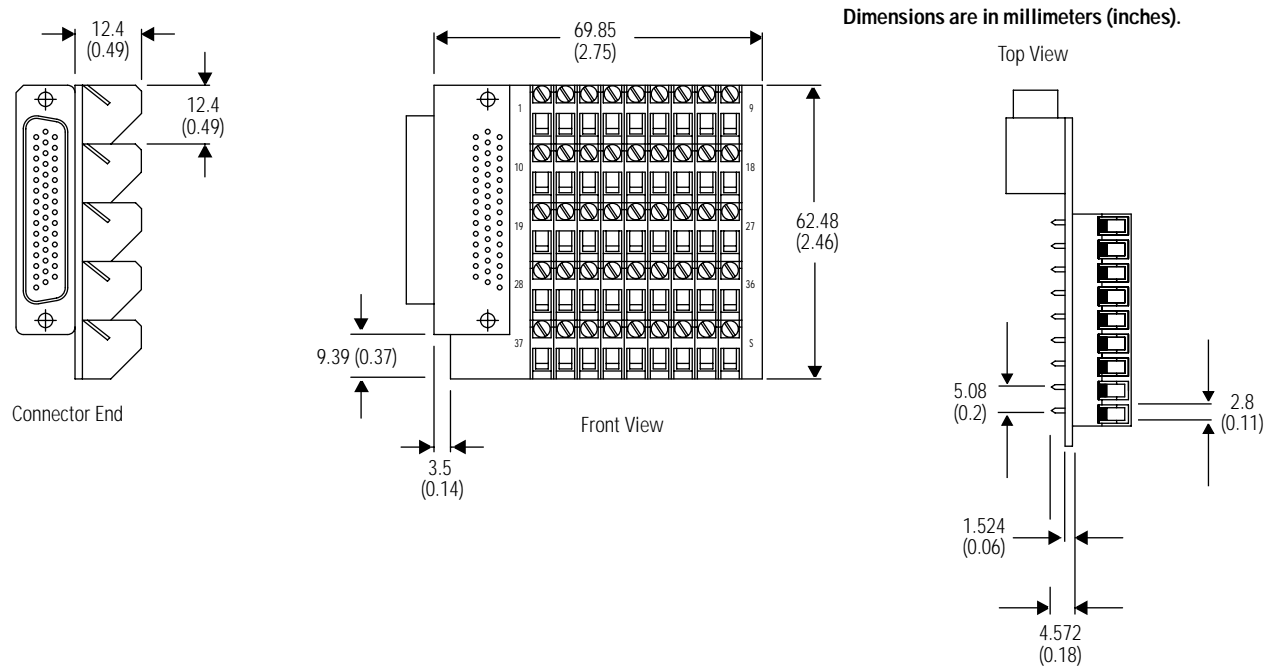


Figure 8.22
44-Pin Drive-Mounted Breakout Board Dimensions (2090-U3BB-DM44)



Cable Dimensions

Figure 8.23
15-Pin Break Out Board Cable Dimensions (2090-UXBC-D15xx)

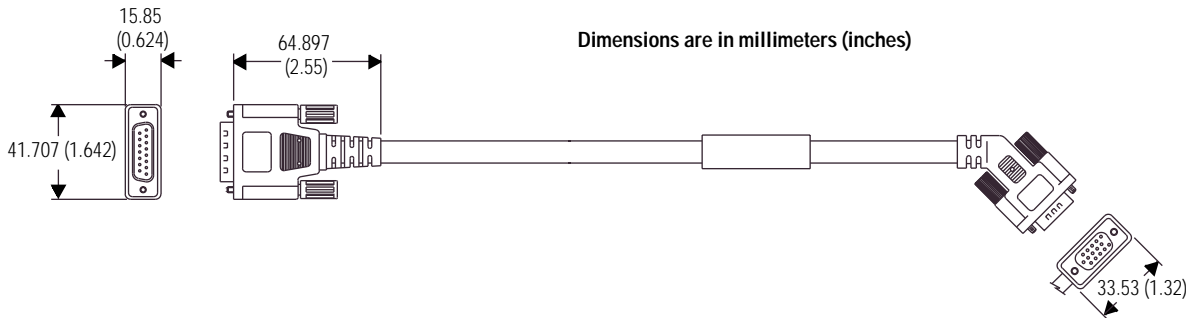
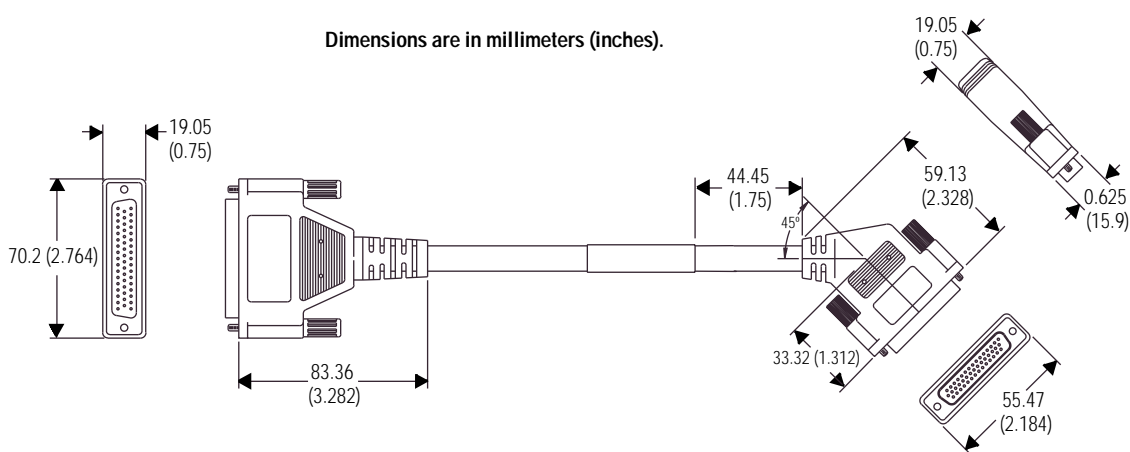


Figure 8.24
44-Pin Break Out Board Cable Dimensions (2090-U3BC-D44xx)

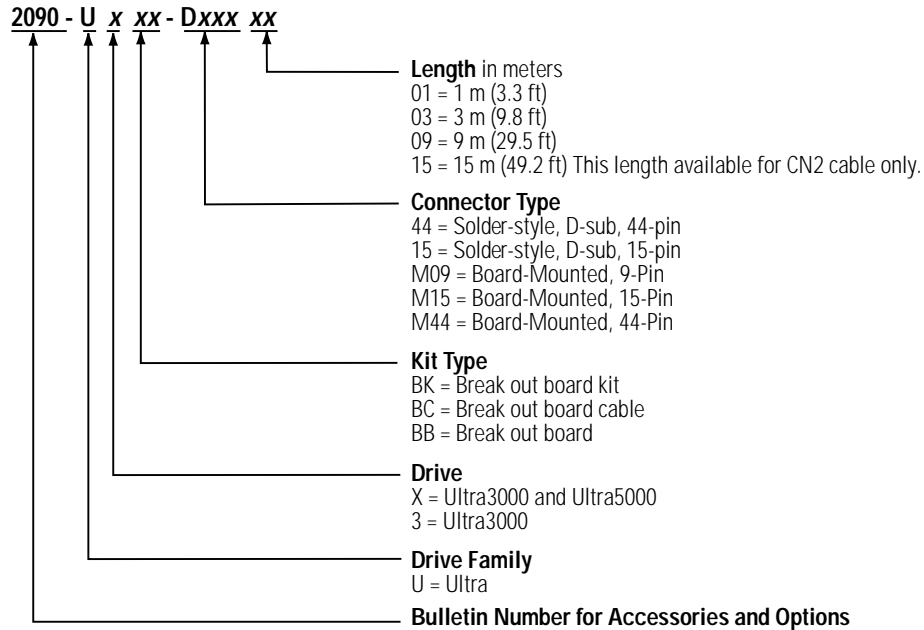


Cable Specifications

Break Out Board Cable	Description	Specifications		
		Rating ° C (° F), Volts	Shield Coverage	Jacket Material
2090-UXBC-D15xx	15-pin, high density D-shell for Ultra3000/5000, CN2	90° C (194° F)	100% Aluminum Foil (with 85% braid overshield)	Thermoplastic Elastomer
2090-U3BC-D44xx	44-pin, high density D-shell for Ultra3000, CN1	90° C (194° F)	100% Aluminum Foil (with 85% braid overshield)	Thermoplastic Elastomer

Break Out Component Catalog Numbers

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering charts below to understand the configuration of your product. For questions regarding product availability, contact your Allen-Bradley distributor.



Ultra Family Connector Kits

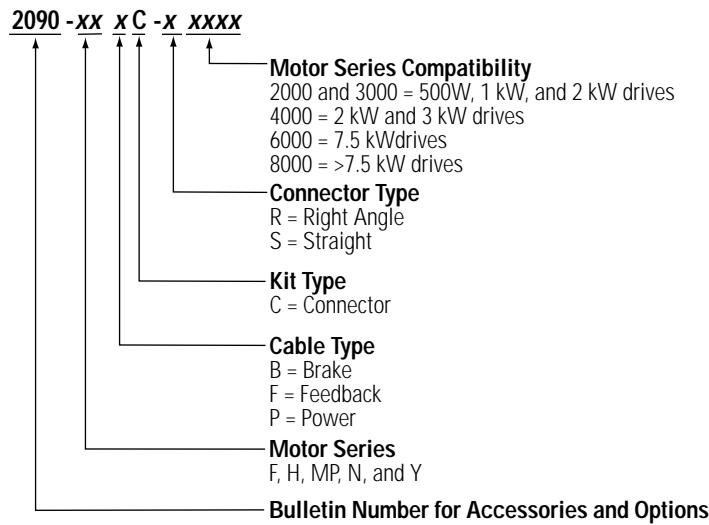
The following sections contain the motor connector kit descriptions, mating connector kit descriptions, and the connector kit catalog numbers for the Ultra3000/5000 drives.

Motor Connector Kits

Motor Series	Motor Connector Kit	Description
F-4000	9101-0326	Straight Power Connector Kit Compatible with 2 and 3 kW Drives
	9101-0399	Right-Angle Power Connector Kit Compatible with 2 and 3 kW Drives
F-6000	9101-0327	Straight Power Connector Kit Compatible with 7.5 kW Drives
	9101-0400	Right-Angle Power Connector Kit Compatible with 7.5 kW Drives
F-Series	9101-0329	Straight Feedback Connector Kit
	9101-0330	Straight Brake Connector Kit
	9101-0402	Right-Angle Feedback Connector Kit
	9101-0403	Right-Angle Brake Connector Kit
H-2000	9101-0325	Straight Power Connector Kit Compatible with .5, 1, and 2 kW drives
	9101-0398	Right-Angle Power Connector Kit Compatible with .5, 1, and 2W drives
H-3000	9101-0325	Straight Power Connector Kit Compatible with .5, 1, and 2W drives
	9101-0398	Right-Angle Power Connector Kit Compatible with .5, 1, and 2W drives
H-4000	9101-0326	Straight Power Connector Kit Compatible with 2 and 3 kW Drives
	9101-0399	Right-Angle Power Connector Kit Compatible with 2 and 3 kW Drives
H-6000	9101-0327	Straight Power Connector Kit Compatible with 7.5 kW Drives
	9101-0400	Right-Angle Power Connector Kit Compatible with 7.5 kW Drives
H-8000	9101-0328	Straight Power Connector Kit Compatible with Drives >7.5 kW
	9101-0401	Right-Angle Power Connector Kit Compatible with Drives >7.5 kW
H-Series	9101-0329	Straight Feedback Connector Kit
	9101-0330	Straight Brake Connector Kit
	9101-0402	Right-Angle Feedback Connector Kit
	9101-0403	Right-Angle Brake Connector Kit
MP-Series	2090-MPPC-S	Straight Power Connector Kit
	2090-MPFC-S	Straight Feedback Connector Kit
	2090-MPBC-S	Straight Brake Connector Kit
N-Series	9101-1557	Straight Power Connector Kit
	9101-1558	Straight Feedback Connector Kit
	9101-1698	Brake Connector Kit
Y-Series	9106-0066	Straight Power and Feedback Connector Kit

Motor Connector Kit Catalog Numbers

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your kit. For questions regarding product availability, contact your Allen-Bradley distributor.

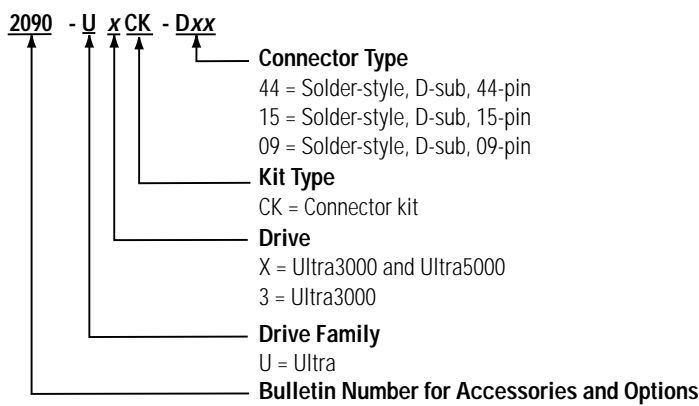


Mating Connector Kits

Connector Kit	Description
2090-UXCK-D09	Mating Connector Kit (9-pin standard density D-shell) for Ultra3000/5000
2090-UXCK-D15	Mating Connector Kit (15-pin high density D-shell) for Ultra3000/5000
2090-U3CK-D44	Mating Connector Kit (44-pin high density D-shell) for Ultra3000

Mating Connector Kit Catalog Numbers

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your kit. For questions regarding product availability, contact your Allen-Bradley distributor.



Ultra Family AC Line Filters

The following sections contain Ultra Family AC line filter descriptions, dimensions and catalog number information.

AC Line Filters	Description	Roxburgh Catalog Number	Drives
9101-1516	Single phase, 6A	MIF06-GS	Ultra3000/Ultra5000 500W
9101-1517	Single phase, 10A	MIF10-GS	Ultra3000/Ultra5000 1 kW
9101-1518	Single phase, 23A	MIF23-GS	Ultra3000/Ultra5000 2 kW
9101-1387	Single phase, 36A	MDF36-M6-GS	Ultra3000/Ultra5000 3 kW
9101-1388	Single phase, 50A	MDF50-M6-GS	Multiple Ultra3000/Ultra5000 drives
9101-1389	Three phase, 36A	MDF336-M6-GS	Ultra3000/Ultra5000 7.5 kW
9101-1390	Three phase, 70A	MDF370-M6-GS	Multiple Ultra3000/Ultra5000 drives
9101-1575	Three phase, 50A	MDF350-M6-GS	Ultra3000/Ultra5000 15 kW

AC Line Filter Dimensions

Figure 8.25
AC Line Filter (9101-1516) for 500W Ultra3000/5000 Drives

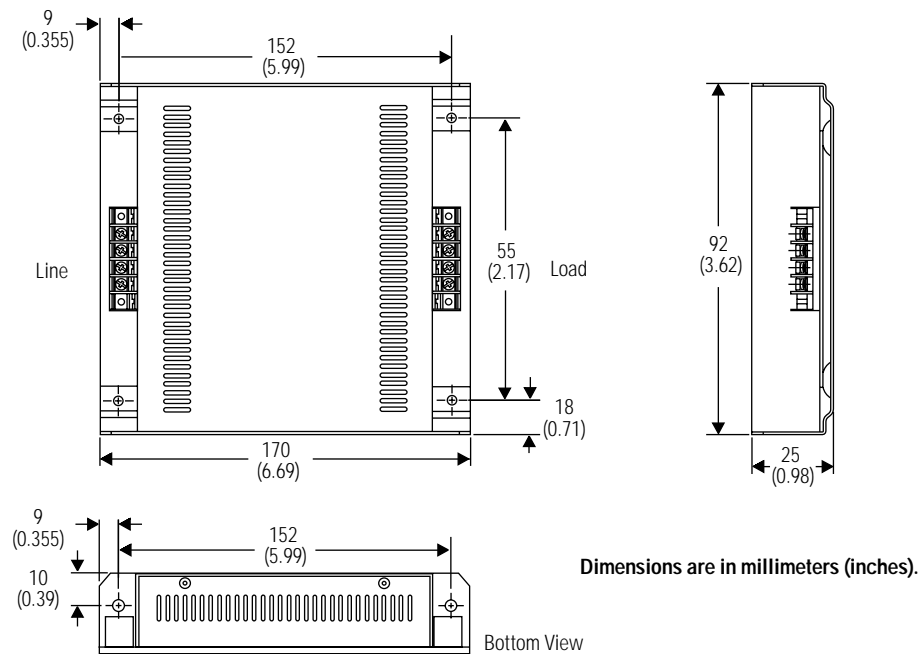


Figure 8.26
AC Line Filter (9101-1517) for 1 kW Ultra3000/5000 Drives

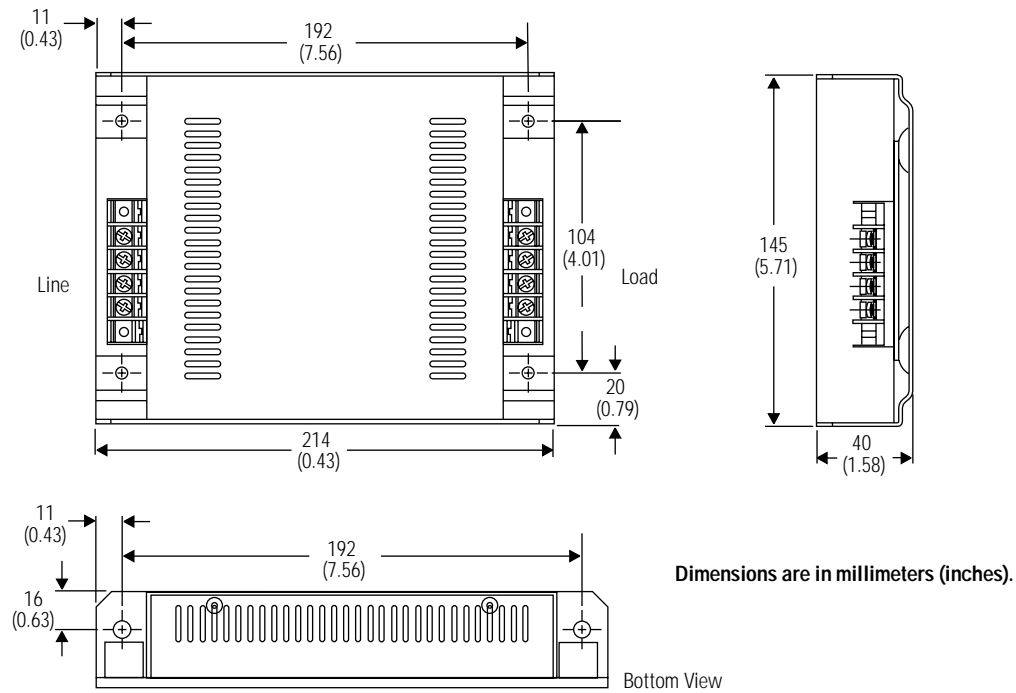


Figure 8.27
AC Line Filter (9101-1518) for 2 kW Ultra3000/5000 Drives

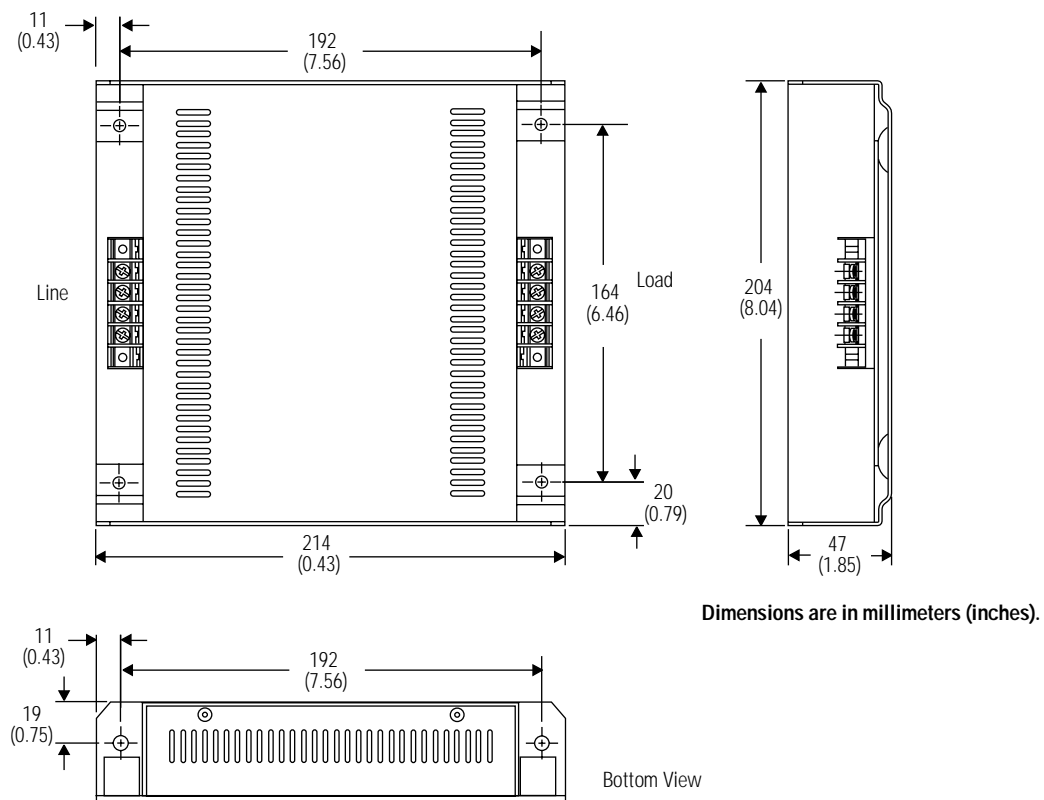


Figure 8.28
AC Line Filter (9101-1387) for 3 kW Ultra3000/5000 Drives

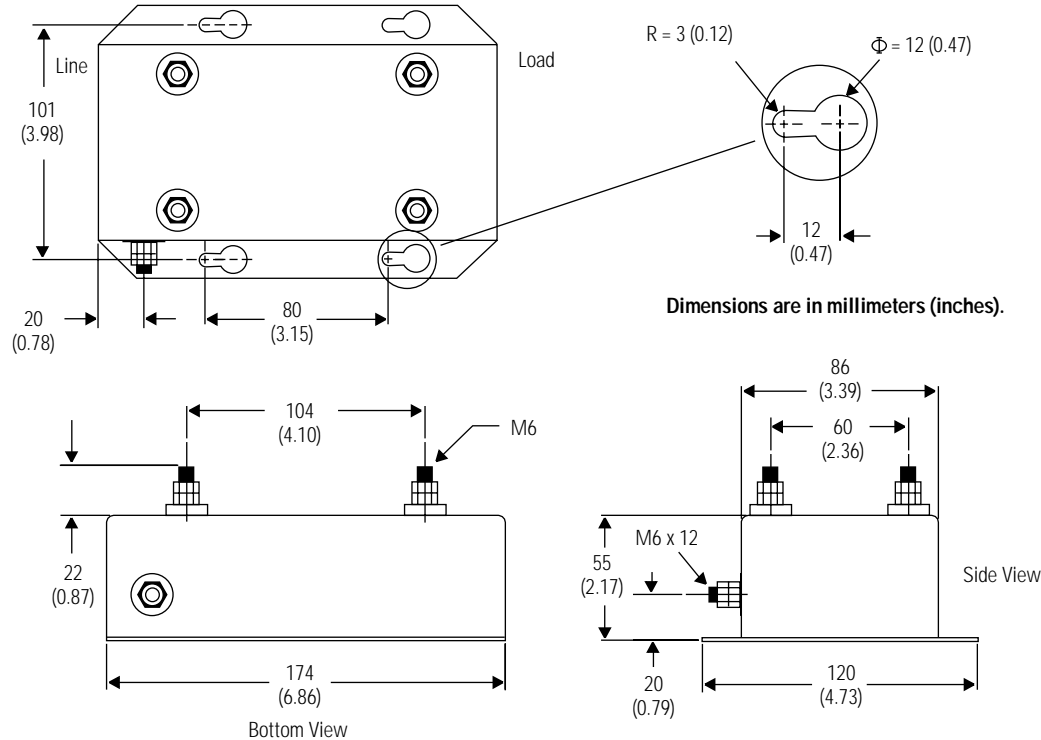


Figure 8.29
AC Line Filter (9101-1388) for use with multiple Ultra3000/5000 drives)

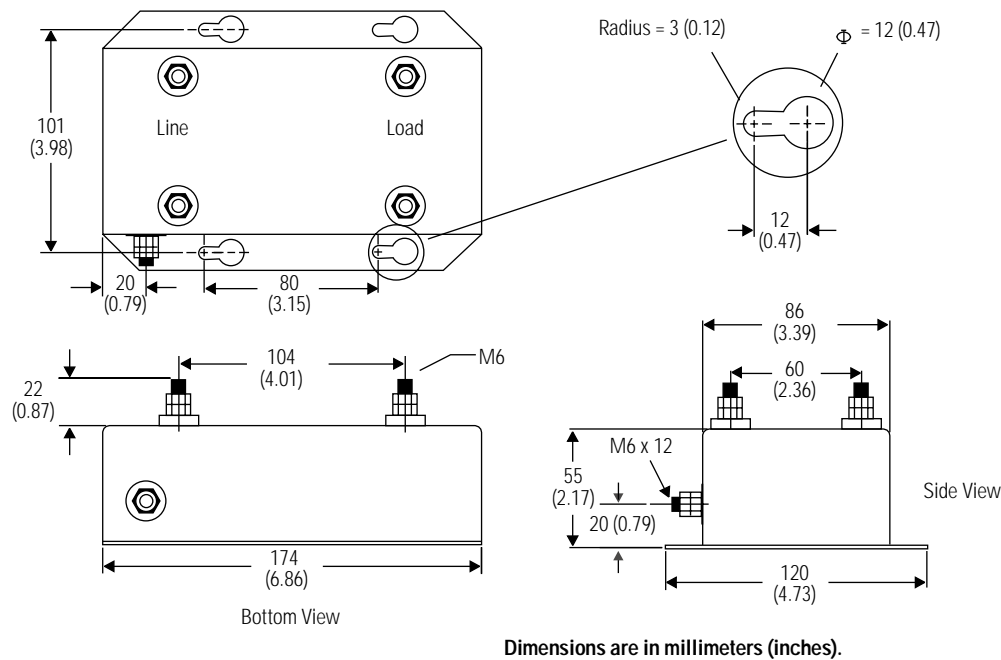


Figure 8.30
AC Line Filter (9101-1389) for 7.5 kW Ultra3000/5000 Drives

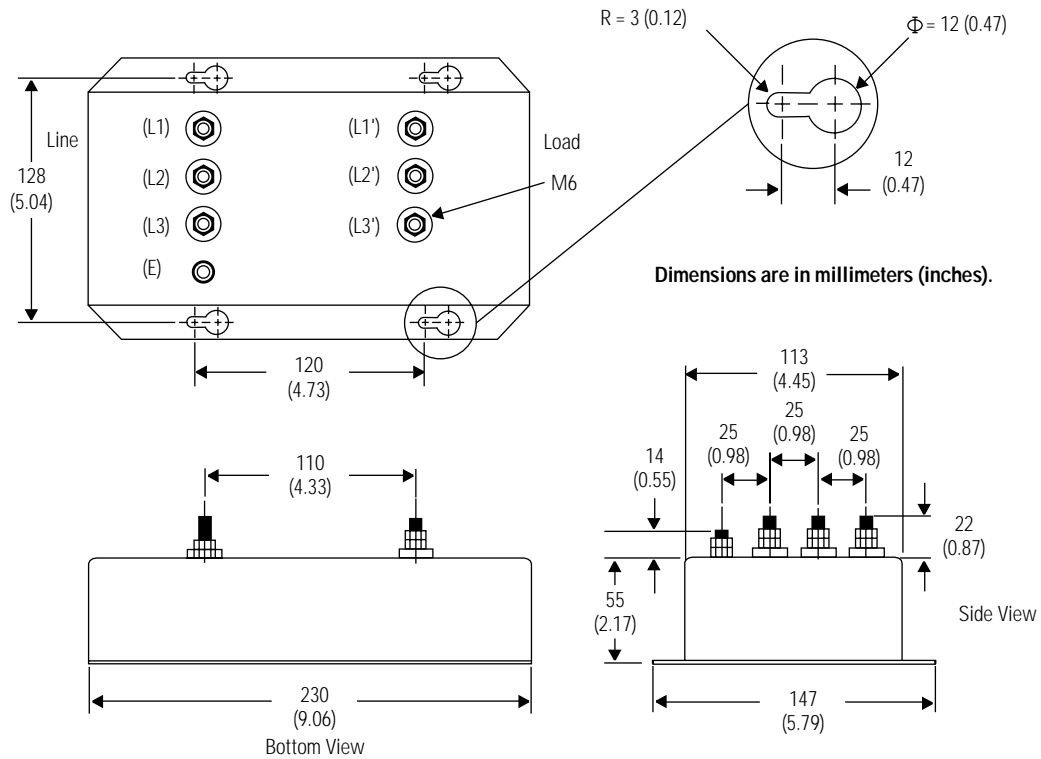


Figure 8.31
AC Line Filter (9101-1390) for Multiple Ultra3000/5000 Drives

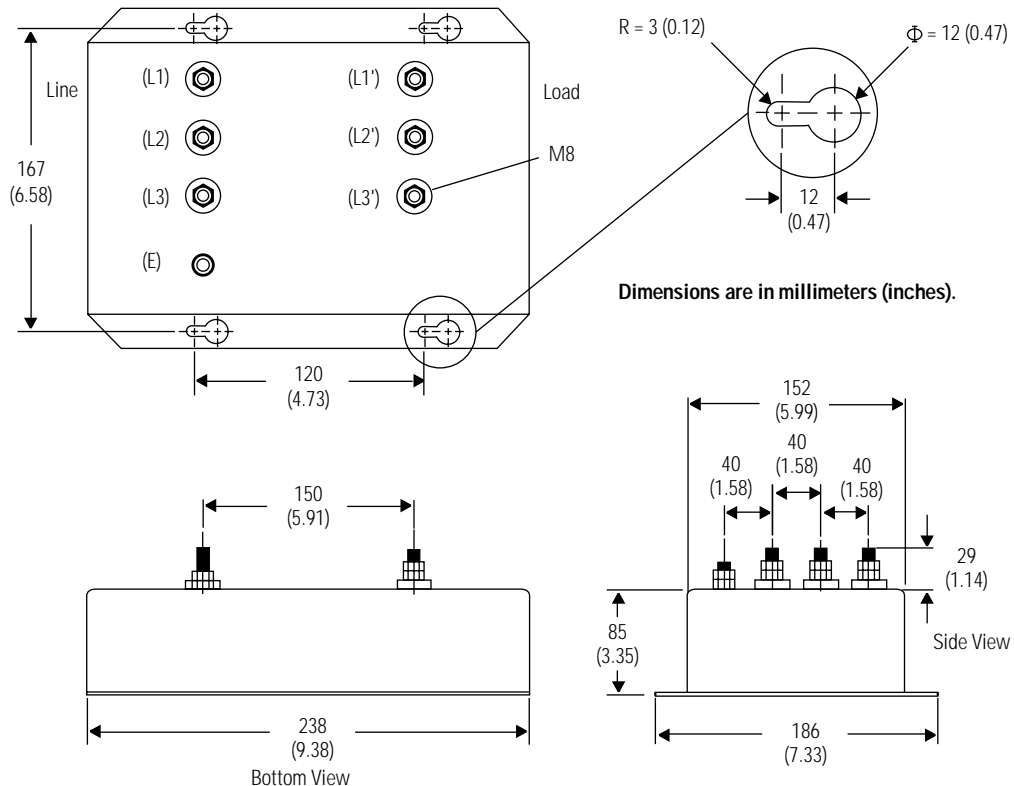
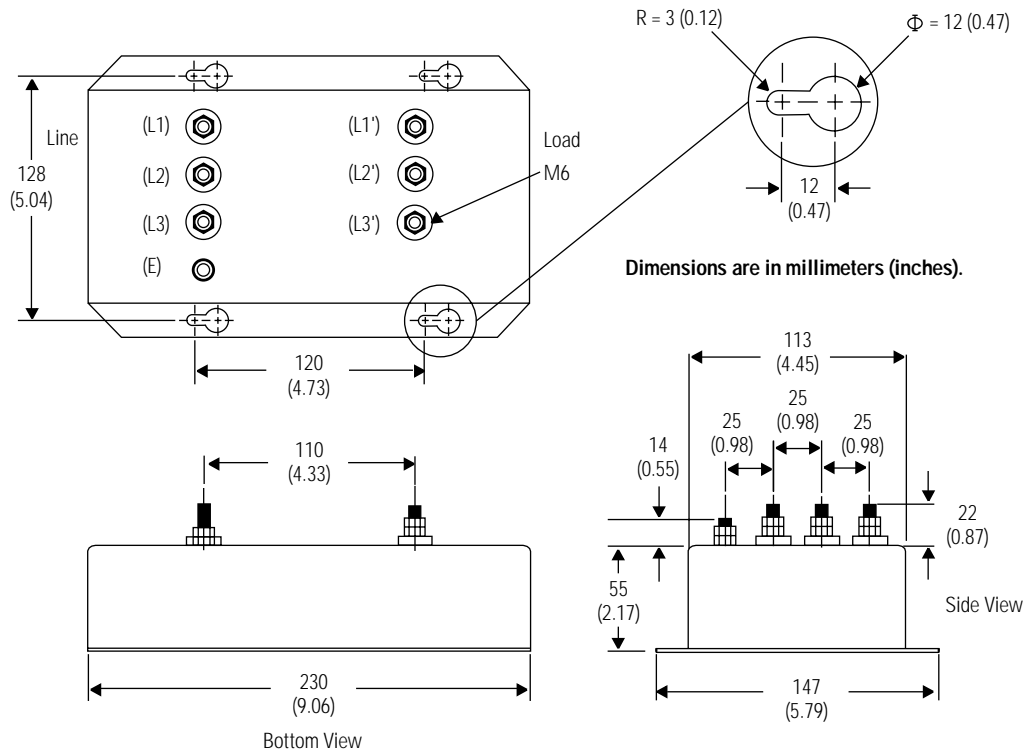


Figure 8.32
AC Line Filter (9101-1575) for 15 kW Ultra3000/5000 Drives



Ultra Family Shunt Resistor Kits

The following sections contain Ultra Family external shunt resistor descriptions, dimensions, and catalog number information.

Shunt Resistor Kits	Description
1398-SR3AF	Active shunt, 300W for use with 500W, 1 kW, and 2 kW drives
9101-1183	Passive shunt, 200W for use with 2 kW to 7.5 kW drives
1398-SR9P	Passive shunt, 900W for use with 7.5 and 15 kW drives

Shunt Resistor Kit Dimensions

Figure 8.33
Active Shunt Resistor Kit (1398-SR3AF)

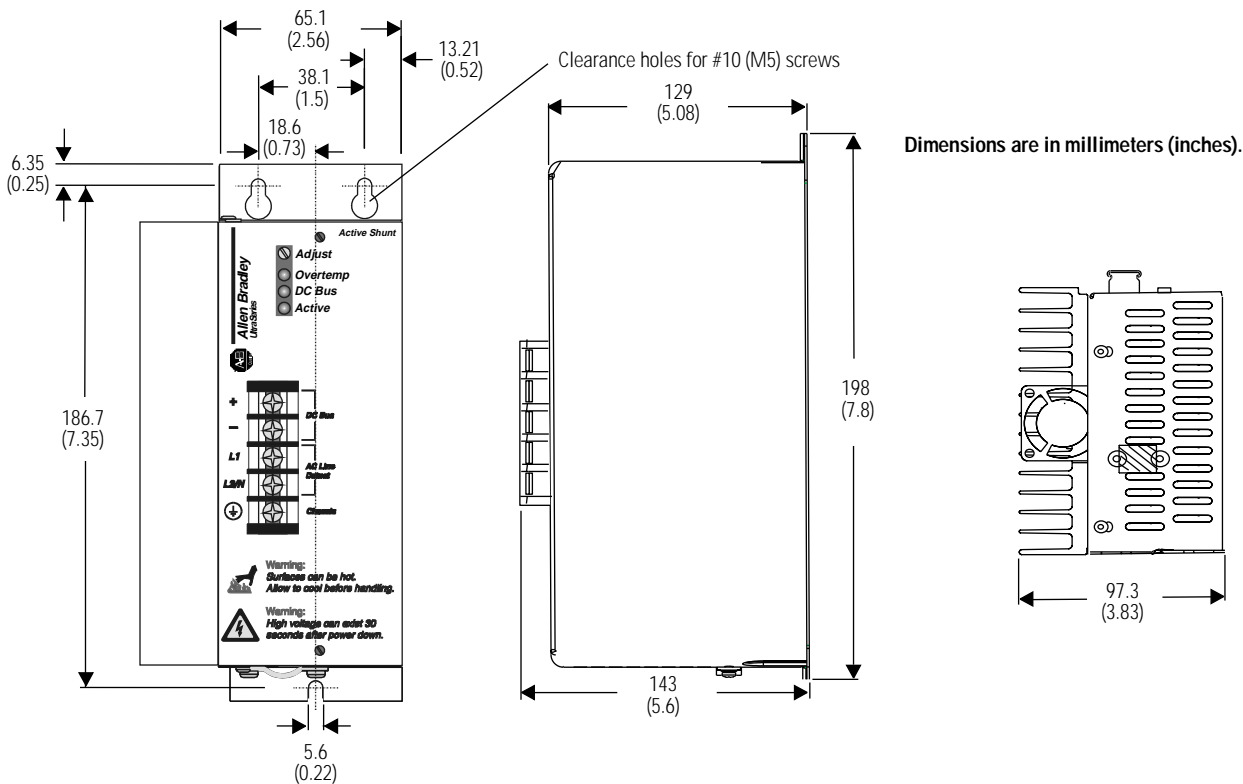


Figure 8.34
Passive Shunt Resistor Kit (9101-1183)

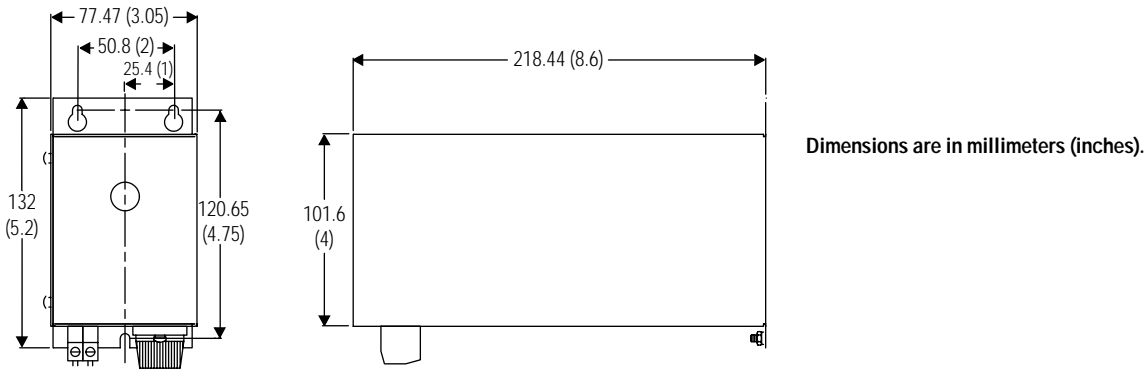
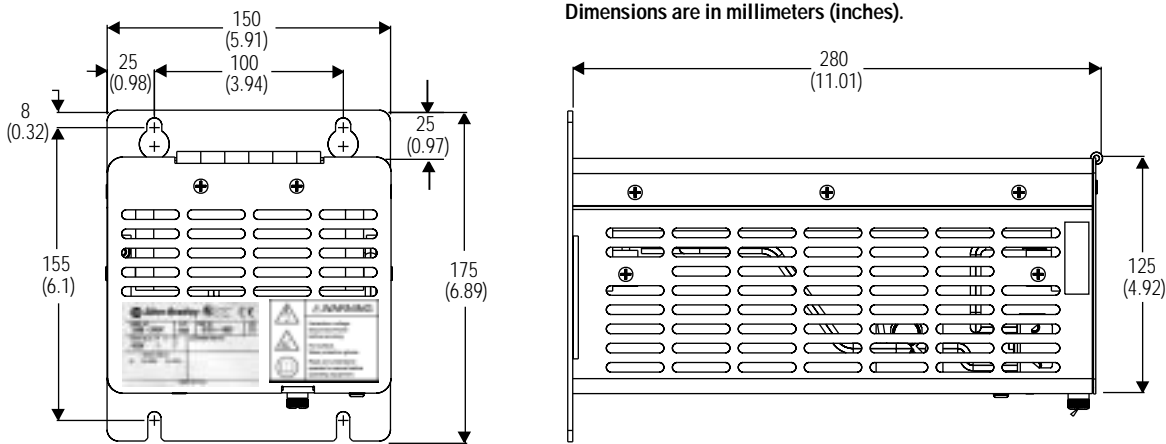


Figure 8.35
Passive Shunt Resistor Kit (1398-SR9P)



Ultra Family Motor Shaft Seal Kits

The following section contains 2098 Ultra Family motor shaft seal kit combinations, dimensions and catalog number.

Motor Shaft Seal Kit Combinations and Dimensions

Motor Series	Catalog Number	Inside Diameter mm (in.)	Outside Diameter mm (in.)	Width mm (in.)
F-4000	0041-5060	22.225 (0.875)	36.4998 (1.437)	6.35 (0.25)
F-6000	0041-5061	36.525 (1.438)	53.975 (2.125)	7.874 (0.31)
H-2000	0041-5056	12 (0.47)	22 (0.87)	7 (0.27)
H-3000	0041-5065	15 (0.58)	35 (1.4)	7 (0.27)
H-4000	0041-5058	20 (0.79)	47 (1.85)	7 (0.27)
H-6000	0041-5059	38 (1.5)	80 (3.15)	8 (0.31)
H-8000	0041-5053-005	45 (1.77)	85 (3.35)	8 (0.31)
MPL-A300	MPL-SSN-A3B3	17 (0.67)	47 (1.85)	7 (0.28)
MPL-A400	MPL-SSN-A4B4	20 (0.79)	52 (2.05)	7 (0.28)
MPL-A500	MPL-SSN-A5B5	25 (0.985)	62 (2.44)	7 (0.28)
N-2300	0041-5056	6.35 (0.25)	22.225 (0.875)	3.175 (0.125)
N-3400	0041-5065	12.7 (0.5)	28.575 (1.125)	6.35 (0.25)
N-4200	0041-5058	15.875 (0.625)		
N-5600	0041-5059	19.05 (0.75)		

Note: Lubricant is provided with each shaft seal kit to reduce wear.


Note: Shaft seals are made of nitrile.

Note: Shaft seal kits are not available for Y-Series motors.

2098 Ultra Family Motor Shaft Seal Kit Catalog Number

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your motor shaft seal kit. For questions regarding product availability, contact your Allen-Bradley distributor.

0041-xxxx


Bulletin Number

Motor Series: 2000, 2300, 3000, 3400, 4000, 4200, 5600, 6000, 8000

1394 System Family

The following sections contain the dimensions, specifications, and catalog numbers for the 1394 cables, AC line filters, shunt modules, and other accessory items.

1394 System Module Cable Dimensions

The following section contains dimensions for the 1394 system module to ControlLogix 1756-M02AE module interface cables.

Figure 8.36
Single-Axis Flying Lead Cable (1394-CFLAE01, -03, -08, and -15 Cable)

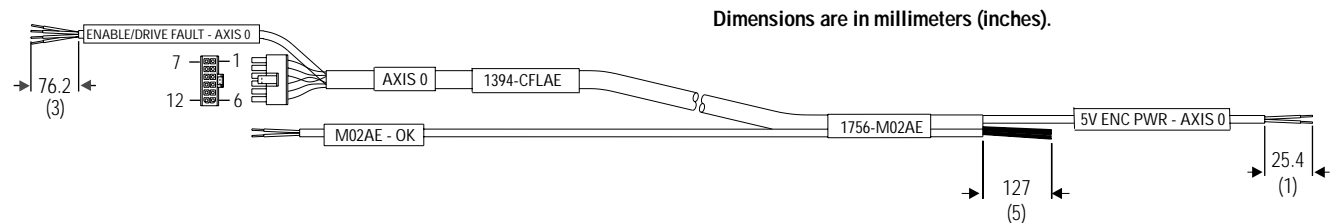


Figure 8.37
Two-Axis Prewired Cable (1394-CCAE01, -03, -08, and -15 Cable)

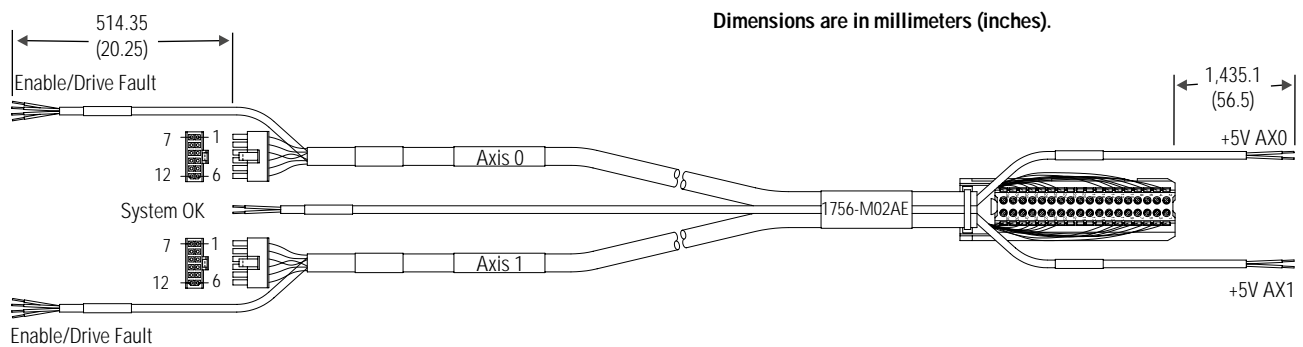


Figure 8.38
Resolver-to-GMC System Module Cable (1394-GR04 Cable)

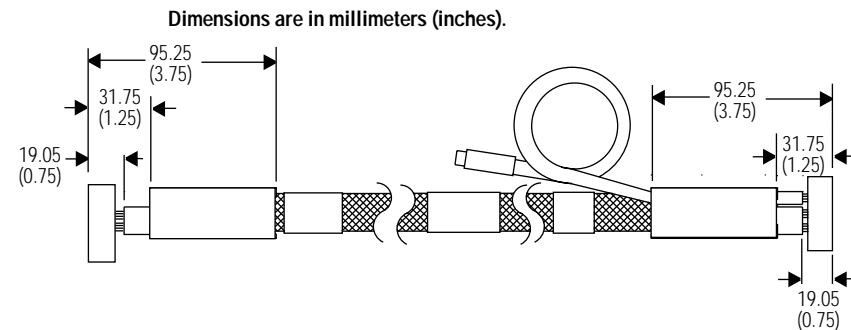


Figure 8.39
External Encoder-to-GMC System Module Cable (1394-GE15 Cable)

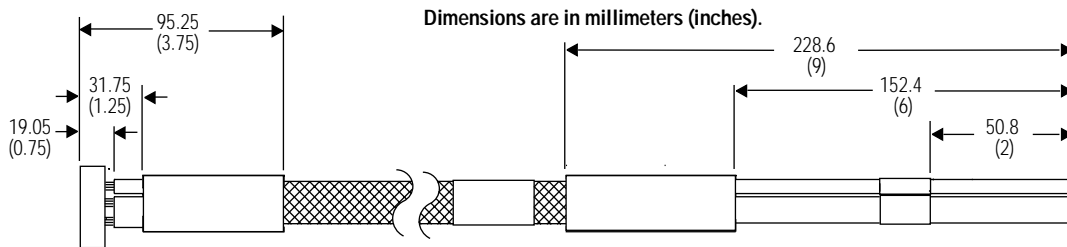
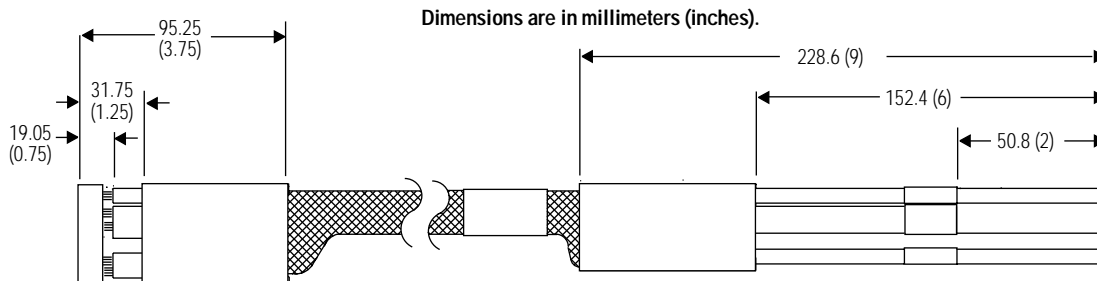


Figure 8.40
Analog Servo-to-Motion Controller Cable (1394-SA15 Cable)



1394 System Module Cable Specifications

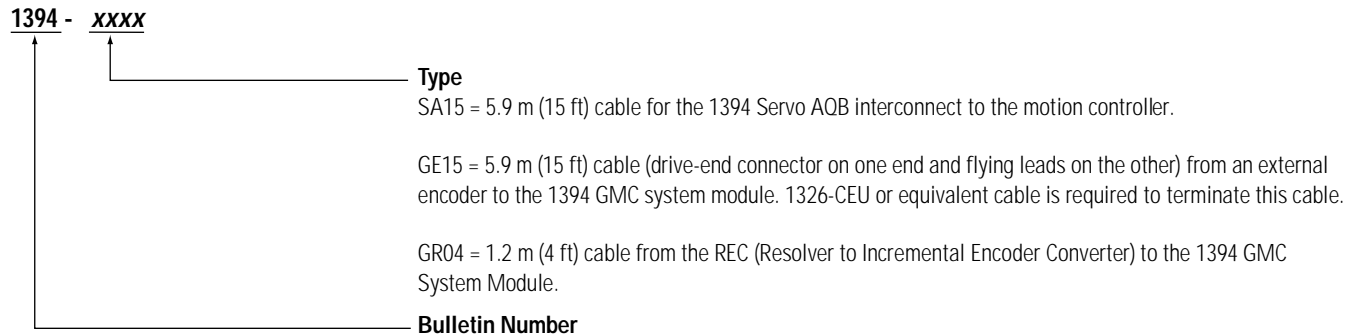
Cable	Description	Specifications			
		Rating ° C (° F), Volts	Shield Coverage	Shield Material	Jacket Material
1394-CFLAE-xx	Single-Axis Flying Lead Cable	80° C (176° F), 300V	100%	Aluminum Foil	Thermoplastic
1394-CCAE-xx	Two-Axis Prewired Cable	80° C (176° F), 300V	100%	Aluminum Foil	Thermoplastic
1394-GR04	Resolver-to-GMC System Module Cable	80° C (176° F), 300V	100%	Aluminum Foil	Thermoplastic (PVC)
1394-GE15	External Encoder-to-GMC System Module Cable	80° C (176° F), 300V	100%	Aluminum Foil	Thermoplastic (PVC)
1394-SA15	Analog Servo-to-Motion Controller Cable	60° C (140° F), 300V	100%	Aluminum Foil	Thermoplastic (PVC)

1394 System Module Cable Catalog Numbers

The following sections contain system module cable catalog numbers for the 1394 system family.

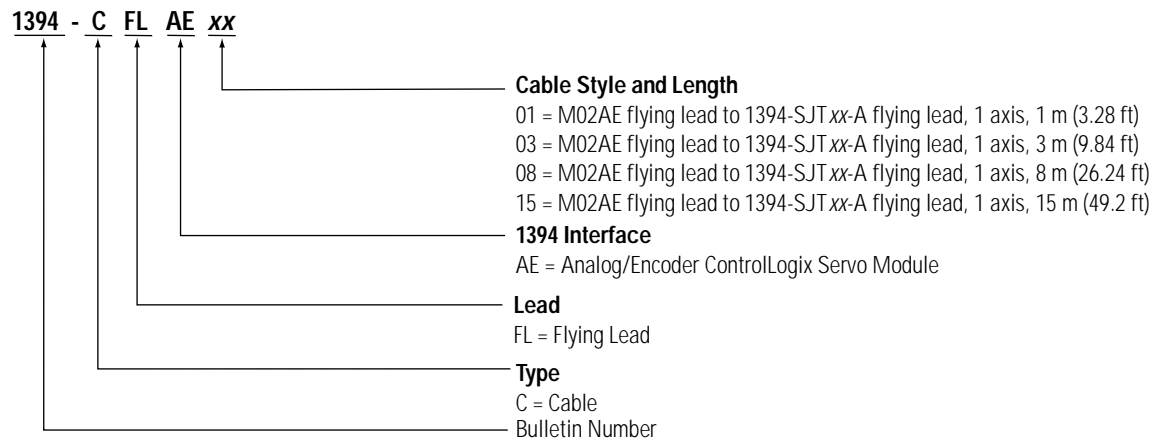
Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering charts below to understand the configuration of your cables. For questions regarding product availability, contact your Allen-Bradley distributor.

General Control Interface Cables

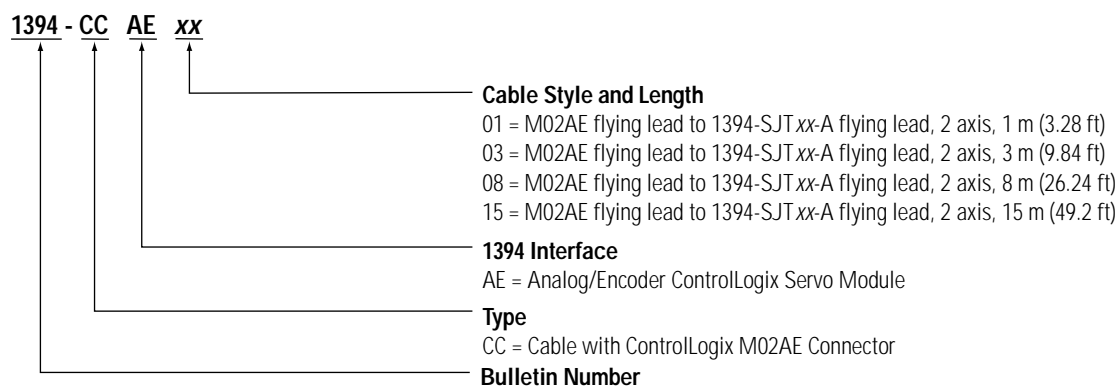


Note: The customer must provide this cable.

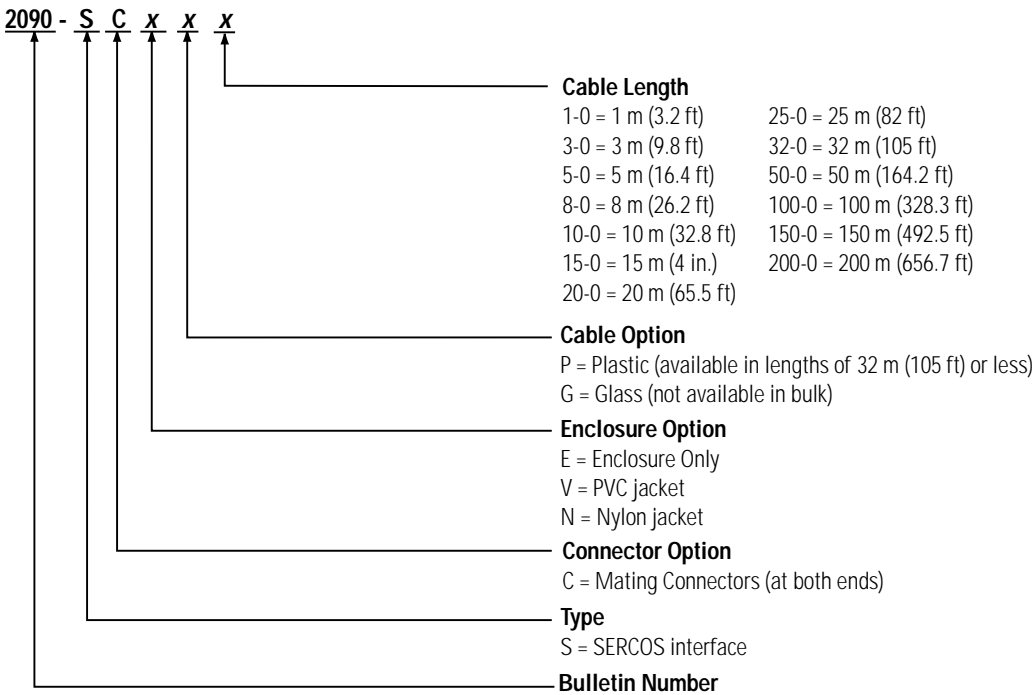
ControlLogix Interface Single Axis Flying Lead Cables



ControlLogix Interface Two-Axis Prewired Cables



SERCOS Interface Fiber-Optic Cables



Note: Lengths of 1 m (3.2 ft) to 32 m (105 ft) are available in plastic or glass. Lengths of 50 m (164.2 ft) to 200 m (656.7 ft) are available in glass only.

Note: The configuration options are limited to the following combinations: -SCEP, -SCVP, -SCNP, and -SCVG.

1394 AC Line Filters

The following section contains specifications and dimensions for the 1394 AC line filters.

Specifications

The:	For the SP-74102-006-01 is:	For the SP-74102-006-02 is:	For the SP-74102-006-03 is:
Frequency	50/60 Hz	50/60 Hz	50/60 Hz
Voltage	460V AC	460V AC	460V AC
Current	23A @ 50° C (122° F)	30A @ 50° C (122° F)	75A @ 50° C (122° F)
Operating Temperature	-25° to 85° C (-13° to 185° F)	-25° to 85° C (-13° to 185° F)	-25° to 85° C (-13° to 185° F)
Vibration	10-200 Hz @ 1.8 g	10-200 Hz @ 1.8 g	10-200 Hz @ 1.8 g
Humidity	90%	90%	90%
Weight	1.6 kg (4.16 lb)	2.7 kg (7.02 lb)	5.2 kg (13.52 lb)
Power Loss	20W	38W	57W
Roxburgh Catalog No.	MIF323-GS	MIF330-GS	MIF375-GS

Dimensions

Figure 8.41
1394 Filter Dimensions (SP-74102-006-01)

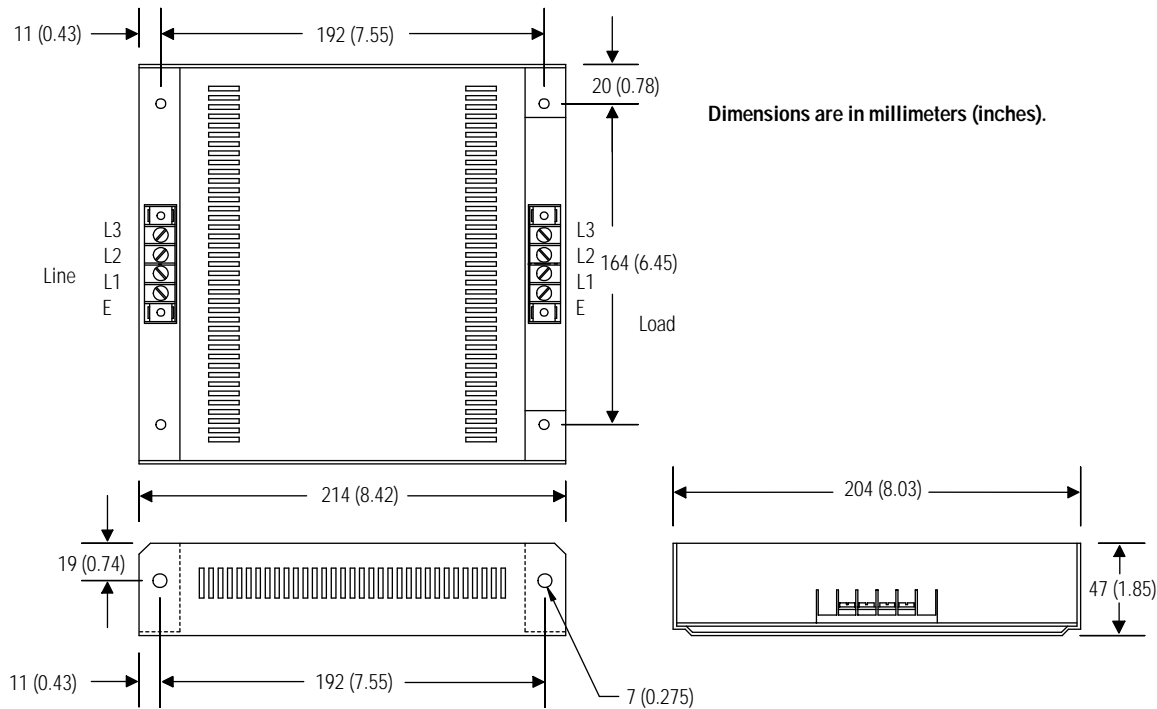


Figure 8.42
1394 Filter Dimensions (SP-74102-006-02)

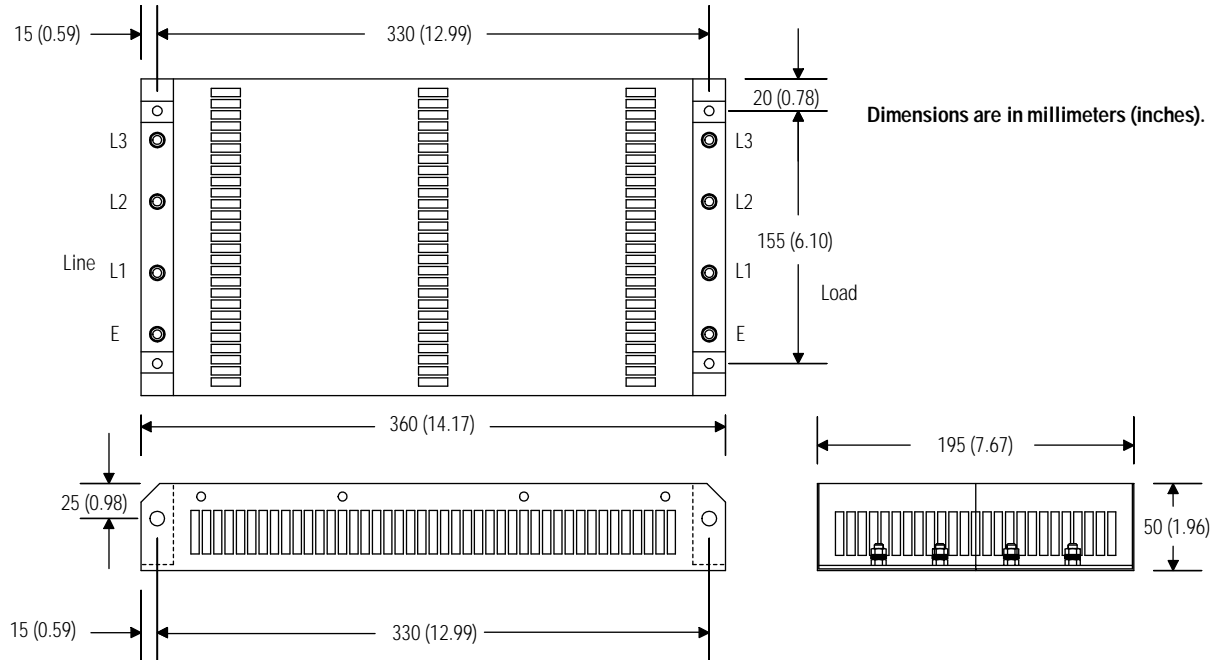
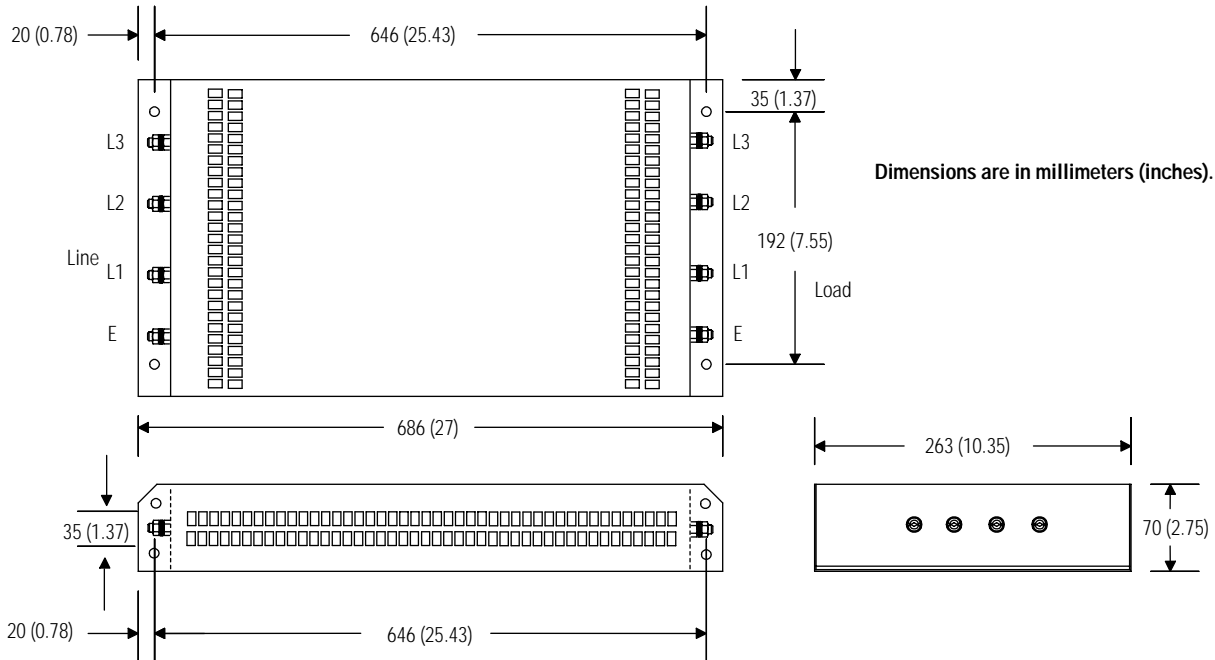


Figure 8.43
1394 Filter Dimensions (SP-74102-006-03)

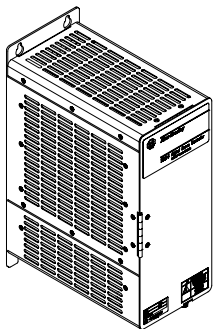


1394 External Shunt Kit and Modules

Shunt modules dissipate excess regenerative power from the Bulletin 1394 system. An external shunt resistor kit (1394-SR10A) is available for 5 and 10 kW systems with regenerative loads that exceed the capacity of the internal 200W shunt resistor provided. Most 5 and 10 kW systems will not require an external shunt resistor kit.

All 22 kW 1394 system modules require an external shunt module (1394-SR9Ax or 1394-SR36Ax). Shunt modules with (rms) power output of 300, 900, 1800 and 3600W continuous, 160,000W peak are available for use with the smart power 22 kW system module. You must use one shunt module with each 22 kW smart power system module. Available in two sizes, each package contains an integral fuse and terminal block. The 3600W package is available with a 115/230V AC cooling fan. Choose your shunt module based on the shunt requirements of the 1326Ax-Bxxxx servo motors you plan to run using the 1394.

Figure 8.44
1394 External Shunt Module



1394 Shunt Module Specifications

The following sections contain shunt module specifications and fuse replacement information for the 1394 system family.

Shunt Resistor Specifications (5 and 10 kW System Shunts)

Shunt Resistor	Specifications			
	Ratings	Power Volts/Amps	Shipping Weight kg (lb)	Resistance Ohms
1394-SR10A	<ul style="list-style-type: none"> 1400W continuous 40,000W peak (two second maximum on time) 	700V, 40A	4.99 (11)	16

Note: Use fuse replacement kit (1394-SR10A-FUSE-A) when replacing the 1394-SR10A shunt fuse.

Shunt Module Specifications (22 kW System Shunts)

Shunt Module	Specification				
	Series Letter	Ratings	Shipping Weight kg (lb)	Resistance	Agency Certifications
1394-SR9A	B	300W continuous, 160,000 W peak, module (no fan)	3.63 (8)	4 Ohms	<ul style="list-style-type: none"> UL Listed C-UL Listed CE marked
1394-SR9AF	B	900W continuous, 160,000 W peak, module (no fan)	3.63 (8)		
1394-SR36A	B	1800W Continuous, 160,000 W peak, module (no fan)	8.6 (19.0)		
1394-SR36AF	B	3600W continuous, 160,000 W peak, fan-cooled module	9.0 (20.0)		

Shunt Module Fuse Replacement Data (22 kW System Shunts)

Shunt Module Marking	Recommended Replacement Fuse
Has the UL mark	Bussmann 600V DC 50A fuse (FWP50A14F) or equivalent as replacement for 1394-SR9A, -SR9AF, -SR36A, and --SR36AF.
Does not have the UL mark	Bussmann 600V DC 40A fuse (170N2013) or equivalent.

1394 Shunt Module Dimensions

Figure 8.45
Shunt Resistor Kit (1394-SR10A)

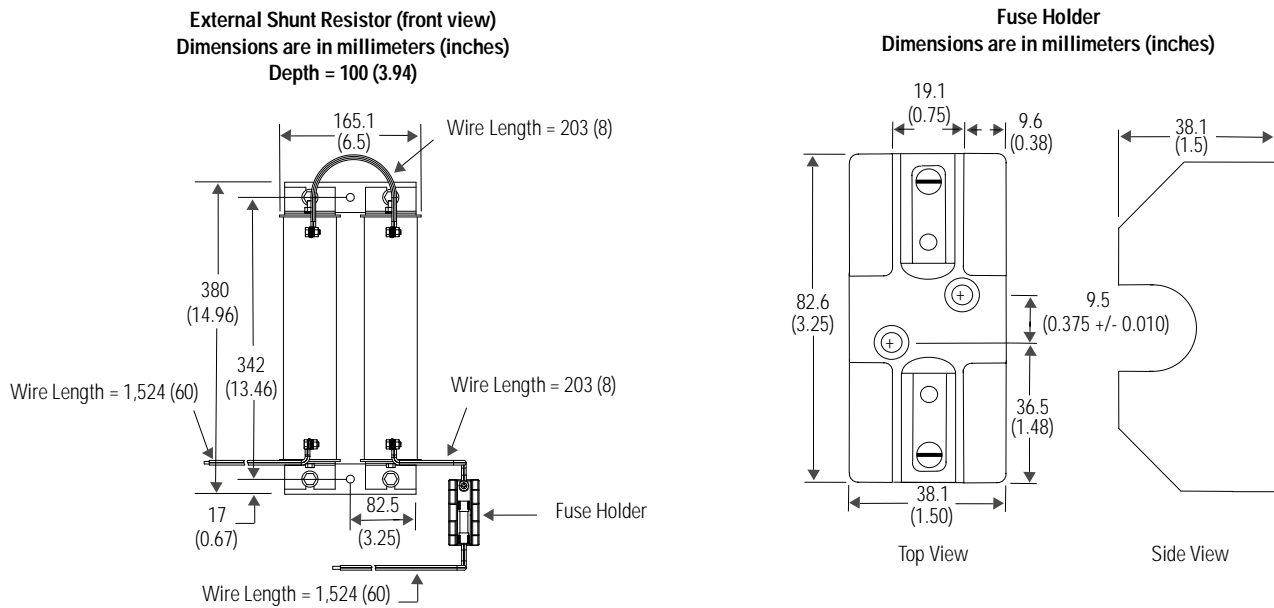


Figure 8.46
Shunt Module (1394-SR-9A and -9AF)

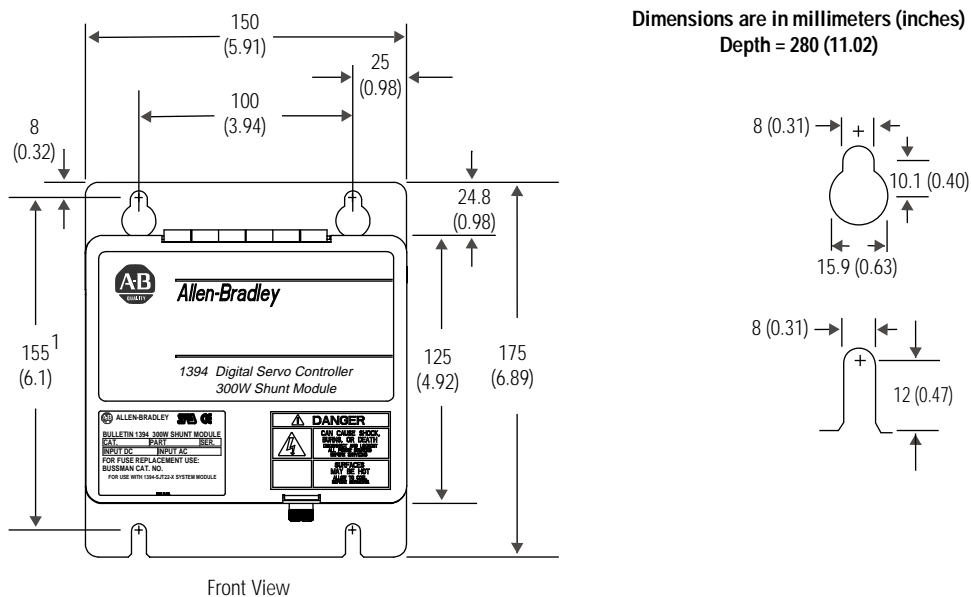


Figure 8.47
Shunt Module (1394-SR-9A and -9AF)

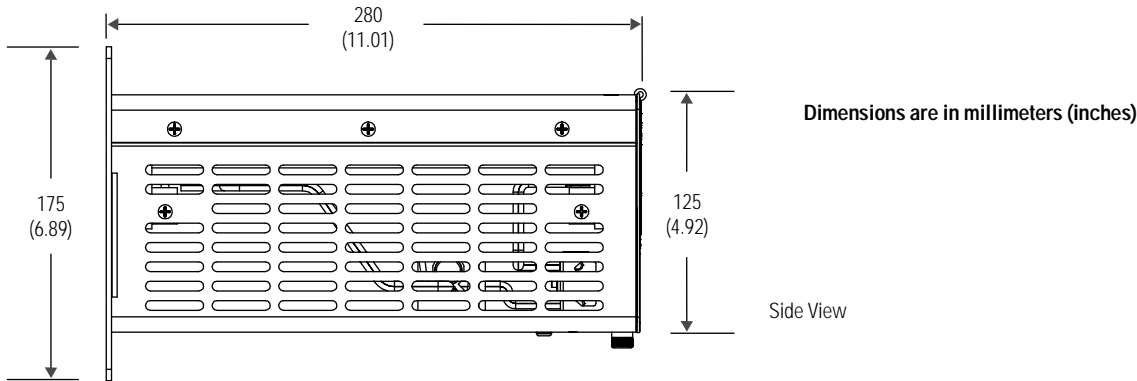


Figure 8.48
Shunt Module (1394-SR-36A and -36AF)

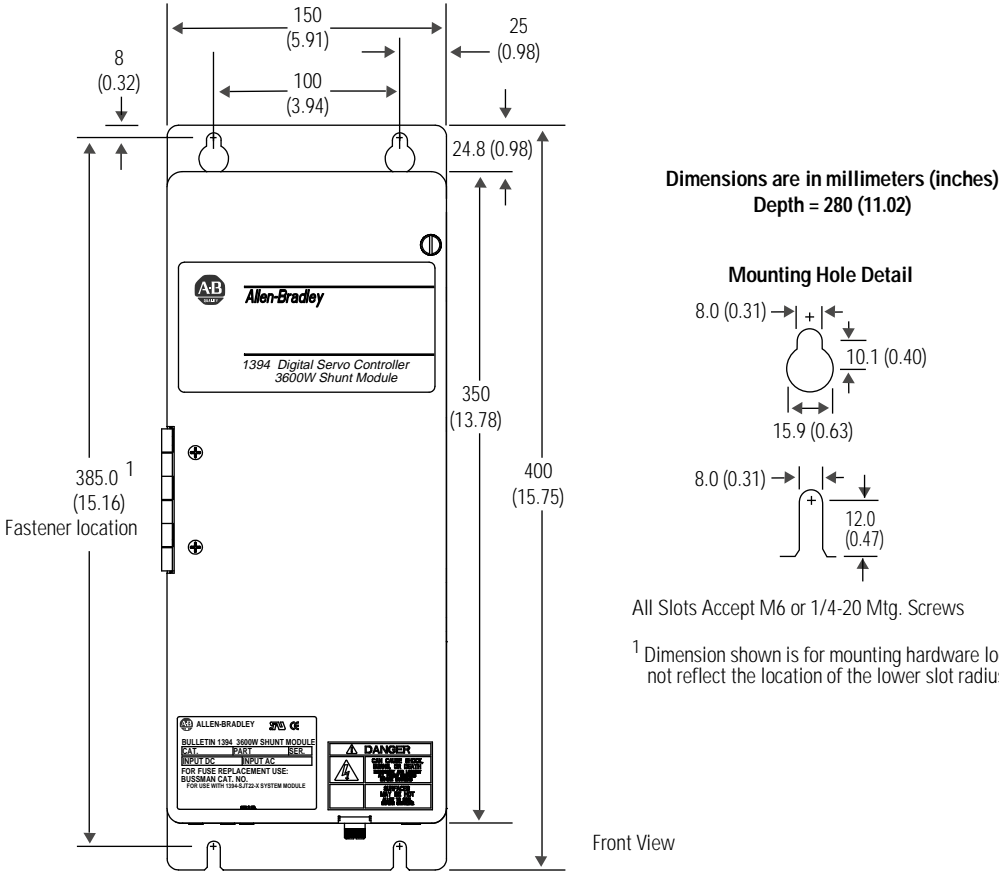
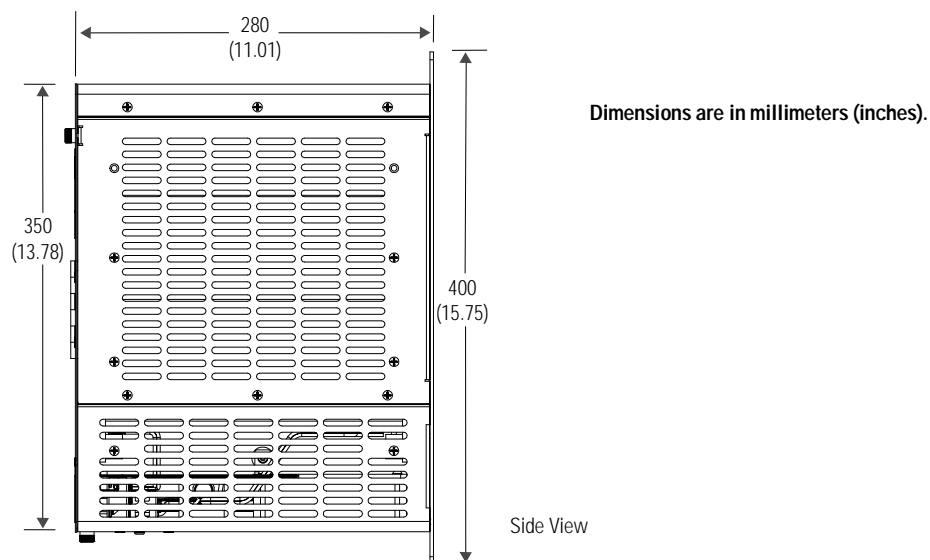


Figure 8.49
Shunt Module (1394-SR-36A and -36AF)



1394 Shunt Module Catalog Numbers

The following sections contain the catalog numbers for the 1394 shunt resistor kit for 5 and 10 kW system modules and the 1394 shunt modules for 22 kW system modules.

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering charts below to understand the configuration of your kit. For questions regarding product availability, contact your Allen-Bradley distributor.

1394 Shunt Resistor Kit for 5 and 10 kW System Modules

1394 - SR 10A

kW Rating

10A = 1400W continuous, 40,000W peak

Type

SR = Shunt resistor

Bulletin Number

1394 Shunt Modules for 22 kW System Modules

1394 - SR xx Ax

Style/kW Rating

9A = 300W continuous, 160,000W peak, no fan

9AF = 900W continuous, 160,000W peak, no fan

36A = 1800W continuous, 160,000W peak, no fan

36AF = 3600W continuous, 160,000W peak, fan-cooled module

Type

SR = Shunt resistor

Bulletin Number

MP-Series 460V Servo Motor Cables

The following sections contains dimensions, specifications, pinouts and catalog numbers for the 460V MP-Series power and feedback cables (MP-Series to 1394 system/axis module).

Dimensions

Figure 8.50
MP-Series 460V Power Cable Dimensions (2090-CDNPBMP-16Sxx, -14Sxx and -10Sxx)

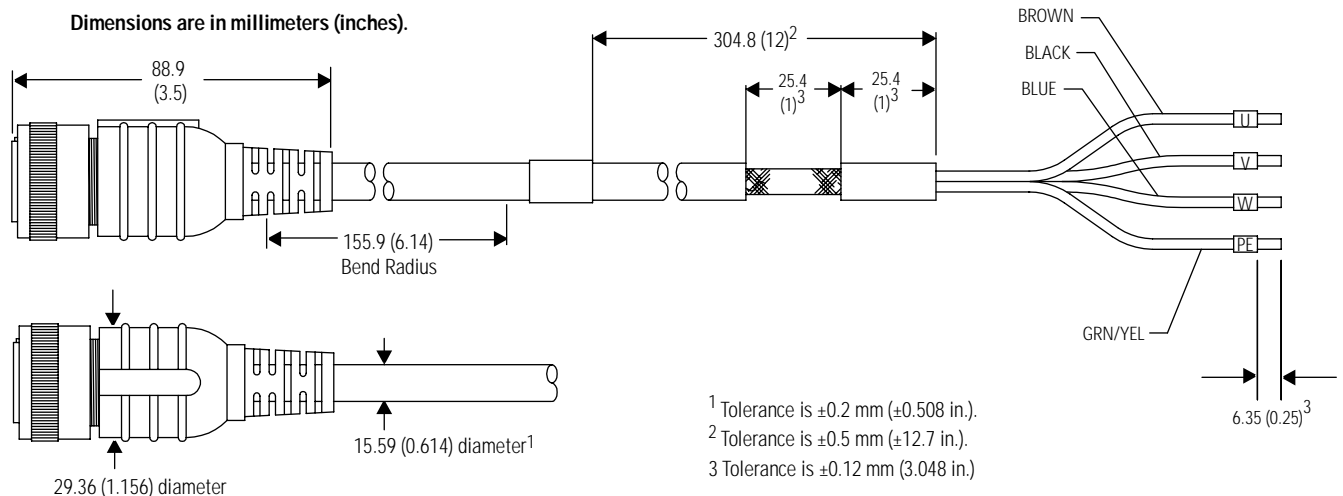
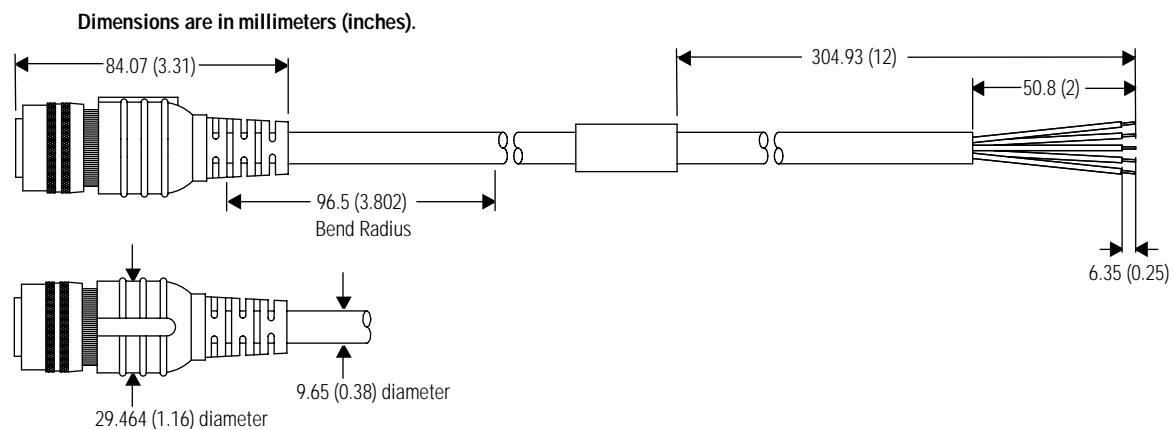


Figure 8.51
MP-Series 460V Resolver and High-Resolution Feedback Cable Dimensions (2090-CDNFDMP-Sxx)



Specifications

The following section contains the specifications for the 460V MP-Series motor power and feedback cables.

Power Cables

Power Cables	Specifications			
	Rating ° C (° F), Volts	Shield Coverage	Shield Material	Jacket Material
2090-CDNPBMP-10S.xx 2090-CDNPBMP-14S.xx 2090-CDNPBMP-16S.xx	105° C (221° F), 600V	85%, Braided	Braided	Elexar

Resolver and High-Resolution Feedback Cable

Feedback Cables	Specifications			
	Rating ° C (° F), Volts	Shield Coverage	Shield Material	Jacket Material
2090-CDNFDMP-S.xx	125° C (257° F), 300V	100% Aluminum Polyester (with 85% braid overshield)	Mylar	Elexar

Pinouts

The following section contains the motor feedback and motor power cable pinouts (460V MP-Series motor to 1394 system module/axis module).

Feedback Cables

2090-CDNFDMP-Sxx Feedback Cable for Motor Resolver					
Pair	Wire Color	Description	Gauge mm ² (AWG)	Connector Pin	System Module Terminal # 1394C-SJTxx-D
1	Black	S2	0.34 (22)	A	1
	White/ Black	S4	0.34 (22)	B	2
2	Red	S1	0.34 (22)	C	3
	White/Red	S3	0.34 (22)	D	4
4	Yellow	R1	0.34 (22)	G	10
	White/ Yellow	R2	0.34 (22)	H	11
6	Blue	TS+	0.34 (22)	R	12
	White/Blue	TS-	0.34 (22)	S	13
		Overall Shield	N/A	no connection	no connection

2090-CDNFDMP-Sxx High-Resolution Feedback Cable					
Pair	Wire Color	Description	Gauge mm ² (AWG)	Connector Pin	System Module Terminal # 1394C-SJTxx-D
1	Black	SIN+	0.34 (22)	A	1
	White/ Black	SIN-	0.34 (22)	B	2
2	Red	COS+	0.34 (22)	C	3
	White/Red	COS-	0.34 (22)	D	4
3	Green	DATA+	0.34 (22)	E	8
	White/ Green	DATA-	0.34 (22)	F	9
5	Orange	+9V DC	0.34 (22)	N	6
	White/ Orange	COMMON	0.34 (22)	P	5
6	Blue	TS+	0.34 (22)	R	12
	White/Blue	TS-	0.34 (22)	S	13
		Overall Shield	N/A	no connection	Cable Clamp

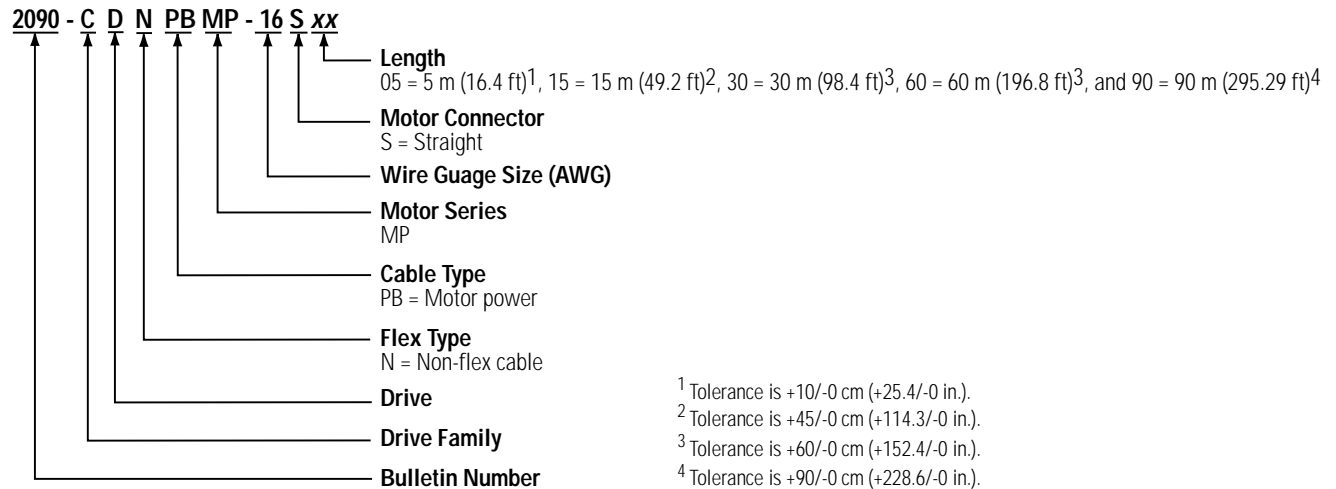
Power Cables

2090-CDNPBMP-16Sxx Motor Power Cable				
Wire Number/ Color	Description	Gauge mm ² (AWG)	Connector Pin	Axis Module Terminal # 1394C-AMxx
U / Brown	Power (U)	1.5 (16)	A	U1
V / Black	Power (V)		B	V1
W / Blue	Power (W)		C	W1
PE / Green/ Yellow	Ground	1.5 (16)	D	PE2
Braided shield	Shield	N/A	N/A	Cable Clamp

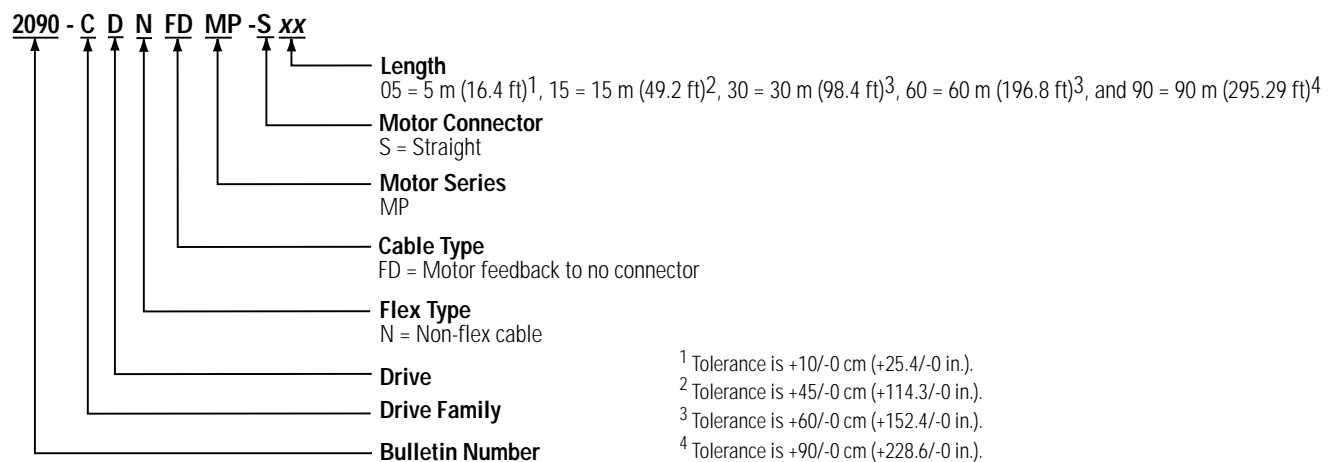
460V MP-Series Motor Cable Catalog Numbers

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering charts below to understand the configuration of your cables. For questions regarding product availability, contact your Allen-Bradley distributor.

460V MP-Series Power Cable Catalog Number



460V MP-Series Feedback Cable Catalog Number



1326AB and 1326AS Motor Cables for 1394 System Family

The following sections contain the 1326AB and 1326AS motor power and motor feedback cable connections, dimensions, specifications, and catalog numbers.

Power and Feedback Motor Cables

Series B Power cables (catalog number 1326-CPB1 and 1326-CPC1) and commutation cables (catalog number 1326-CCU and 1326-CECU) are available in lengths up to 90 m (295 ft) for standard, one-time flex applications. (PLTC 90° C 300V, AWM 90° C 300V for 1326-CCU and 1326-CECU, type TC 90° C 600V for 1326-CPB1 and 1326-CPC1.)

1326 cables features:

- UL Listed (file #E88699) cable assemblies
- A braided cable shield for superior electromagnetic noise immunity
- Molded push/pull connectors at the motor end for easy installation and maintenance
- Cable systems for 1394 System Family
- Standard single-connector cables
- Right-angle connector cables
- In-line system that uses bulkhead and double-ended cables
- Harsh environment cables
- High-resolution feedback cables

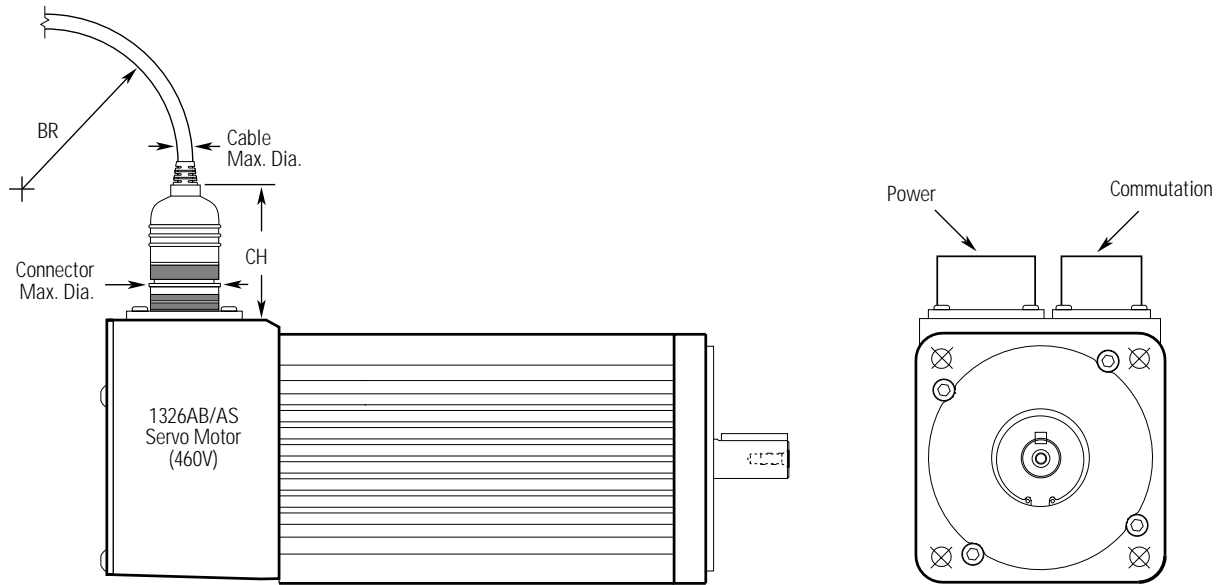
Allen-Bradley also offers high flex-rated cable for power-track applications. Power cables (catalog number 1326-CPB1T and 1326-CPC1T) and commutation cables (catalog number 1326-CCUT and 1326-CECUT) are available in lengths up to 90 m (295 ft). In addition to the features listed for standard cables, each flex-cable features excellent minimum bend radius ratings and a superior flex cycle life.

1326 Cable Dimensions

The following sections contain dimensions for the 1326 standard, right-angle, and bulkhead cables.

Standard Connector Dimensions

Figure 8.52
Motor Power and Feedback Standard Cable Dimensions



Cable	Description	CH ¹ mm (in.)	BR ² mm (in.)	Connector Max. Dia. without -L option mm (in.)	Connector Max. Dia. with -L option mm (in.)	Cable Max. Dia. mm (in.)
1326-CPB1-xxx	Standard power cable for 1326AB-B4xxxx, -B5xxxx, and 1326AS-B3xxxx, -B4xxxx	110.0 (4.3)	76.2 (3.0)	43.2 (1.70)	47 (1.85)	14.0 (0.55)
1326-CPB1T-xxx	Flex-rated power cable for 1326AB-B4xxxx, -B5xxxx, and 1326AS-B3xxxx, -B4xxxx	110.0 (4.3)	104.1 (4.1)	43.2 (1.70)	47 (1.85)	10.4 (0.41)
1326-CPC1-xxx	Standard power cable for 1326AB-B7xxxx, and 1326AS-B6xxxx, -B8xxxx	128.0 (5.0)	76.2 (3.0)	54.1 (2.13)	57.2 (2.25)	16.3 (0.64)
1326-CPC1T-xxx	Flex-rated power cable for 1326AB-B7xxxx, and 1326AS-B6xxxx, -B8xxxx	128.0 (5.0)	160.2 (6.3)	54.1 (2.13)	57.2 (2.25)	16.0 (0.63)
1326-CCU-x-xxx, 1326-CECU-L-xxx	Standard and high resolution feedback cable for motor resolver	110.0 (4.3)	50.8 (2.0)	36.6 (1.44)	40.4 (1.59)	11.0 (0.43)
1326-CCUT-x-xxx, 1326-CECUT-L-xxx	Flex-rated and flex-rated high resolution feedback cable for motor resolver	110.0 (4.3)	101.6 (4.0)	36.6 (1.44)	40.4 (1.59)	10.1 (0.40)

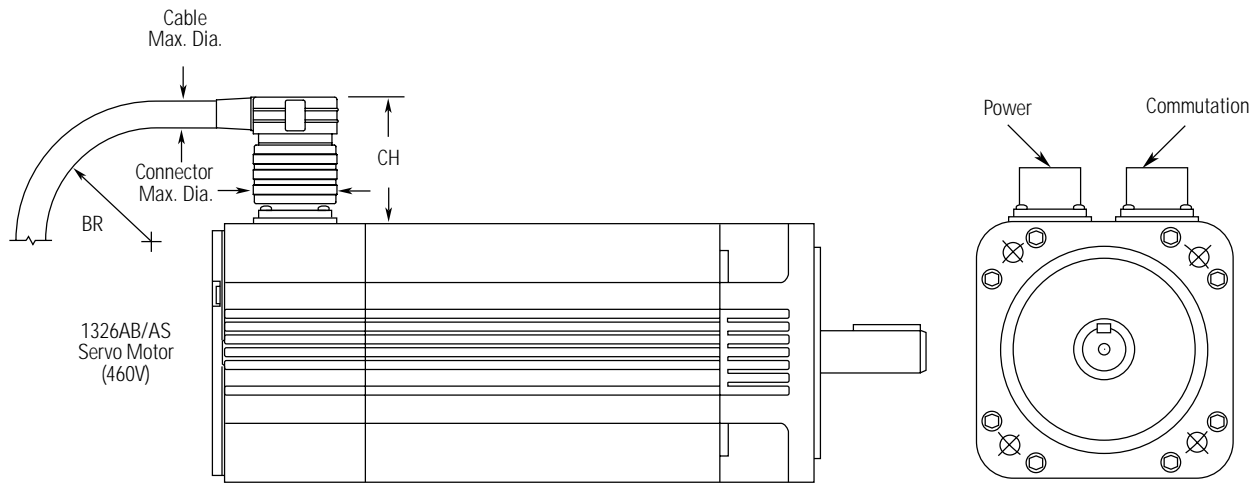
¹ CH is described as the cable connector height.

² BR (bend radius) is the specified bend radius for standard 1326 cable assemblies. BR may vary on user-fabricated cables. For standard cable, BR is a one-time flex application. Flex cables have a much higher BR to withstand flex applications.

Note: Lay all cables flat for 24 hours prior to installation. This allows the conductors to relax into their natural state and guards against internal twisting.

Right-Angle Connector Dimensions

Figure 8.53
Motor Power & Feedback Right-Angle Cable Dimensions



Cable	Description	CH ¹ mm (in.)	BR ² mm (in.)	Connector Max. Dia. without -L option mm (in.)	Connector Max. Dia. with -L option mm (in.)	Cable Max. Dia. mm (in.)
1326-CPB1-RAx-xxx, 1326-CPB1-RBx-xxx	Right-angle power cable for 1326AB-B4xxxx, -B5xxxx, and 1326AS-B3xxxx, -B4xxxx	68.58 (2.7)	76.2 (3.0)	43.18 (1.7)	43.18 (1.7)	14.0 (0.55)
1326-CPB1T-RAx-xxx, 1326-CPB1T-RBx-xxx	Flex-rated right-angle power cable for 1326AB-B4xxxx, -B5xxxx, and 1326AS-B3xxxx, -B4xxxx	68.58 (2.7)	104.1 (4.1)	43.18 (1.7)	43.18 (1.7)	10.4 (0.41)
1326-CPC1-RAx-xxx, 1326-CPC1-RBx-xxx	Right-angle power cable for 1326AB-B7xxxx, and 1326AS-B6xxxx, -B8xxxx	84.07 (3.31)	76.2 (3.0)	53.85 (2.12)	54.36 (2.14)	16.3 (0.64)
1326-CPC1T-RAx-xxx, ¹ 1326-CPC1T-RBx-xxx	Flex-rated right-angle power cable for 1326AB-B7xxxx, and 1326AS-B6xxxx, -B8xxxx	84.07 (3.31)	160.2 (6.3)	53.85 (2.12)	54.36 (2.14)	16.0 (0.63)
1326-CCU-RAx-xxx, 1326-CCU-RBx-xxx, 1326-CECU-RAL-xxx, 1326-CECU-RBL-xxx	Standard and high-resolution feedback cable, right-angle, for motor resolver	69.85 (2.75)	115 (4.5)	36.58 (1.44)	40.4 (1.59)	11.5 (0.45)
1326-CCUT-RAx-xxx, 1326-CCUT-RBx-xxx, 1326-CECUT-RAL-xxx, 1326-CECUT-RBL-xxx	Standard and high-resolution flex-rated feedback cable, right-angle, for motor resolver	69.85 (2.75)	120 (4.7)	36.58 (1.44)	40.4 (1.59)	11.5 (0.45)

¹ CH is the cable connector height.

² BR (bend radius) is the specified bend radius for standard 1326 cable assemblies. BR may vary on user-fabricated cables. For standard cable, BR is a one-time flex application. Flex cables have a much higher BR to withstand flex applications.

Note: Lay all cables flat for 24 hours prior to installation. This allows the conductors to relax into their natural state and guards against internal twisting.

Bulkhead Connector Dimensions

The following tables show dimensions for 1326-CCU_x-E_x, 1326-CPB1_x-E_x, and 1326-CPC1_x-E_x cables. For installation instructions refer to *Bulkhead Connection for Series B 1326 Cable Installation Instructions* (publication 1326A-5.25).

1326 Cable	Screw Threads mm (in)	A mm (in)	B mm (in)	C mm (in)	D mm (in)	E mm (in)
1326-CCU-E-xxx 1326-CCUT-E-xxx 1326-CCUT-EE-xxx 1326-CCU-EL-xxx 1326-CCUT-EL-xxx	4/40 (3/8)	28.58 (1.13)	3.35 (0.13)	26.975 (1.062)	30.16 (1.19)	35.05 (1.38)
1326-CPB1-E-xxx 1326-CPB1T-E-xxx 1326-CPB1T-EE-xxx 1326-CPB1-EL-xxx 1326-CPB1T-EL-xxx	4/40 (3/8)	34.93 (1.38)	3.35 (0.13)	31.75 (1.25)	36.51 (1.44)	41.15 (1.62)
1326-CPC1-E-xxx 1326-CPC1T-E-xxx 1326-CPC1T-EE-xxx 1326-CPC1-EL-xxx 1326-CPC1T-EL-xxx	6/32 (3/8)	43.64 (1.72)	3.81 (0.15)	39.67 (1.56)	45.23 (1.78)	50.80 (2.0)

Figure 8.54
Bulkhead Connector Mounting Hole Dimensions

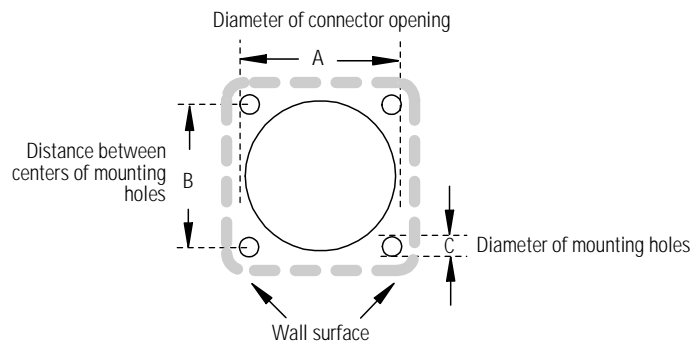
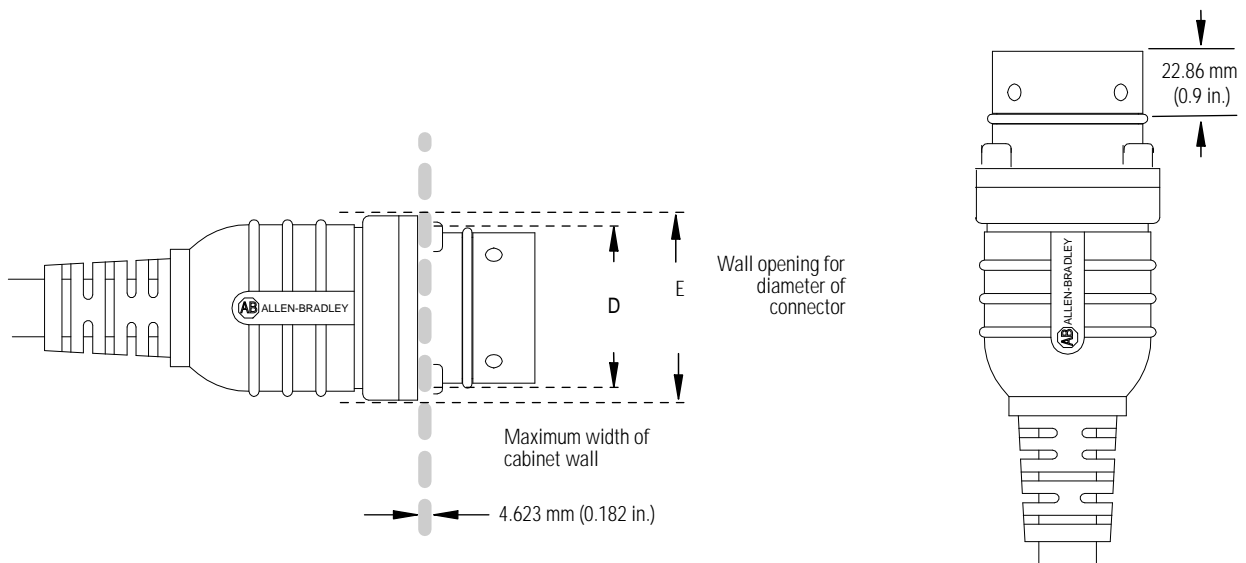


Figure 8.55
Bulkhead Connector Dimensions



1326 Cable Bend Radius Information

Rated Bend Radius in mm (inches)	
1326-CCUT	101.6 (4.0)
1326-CPB1T	104.1 (4.1)
1326-CPC1T	160.2 (6.3)

Figure 8.56
Flex Cycle Life vs. Cable Bend Radius

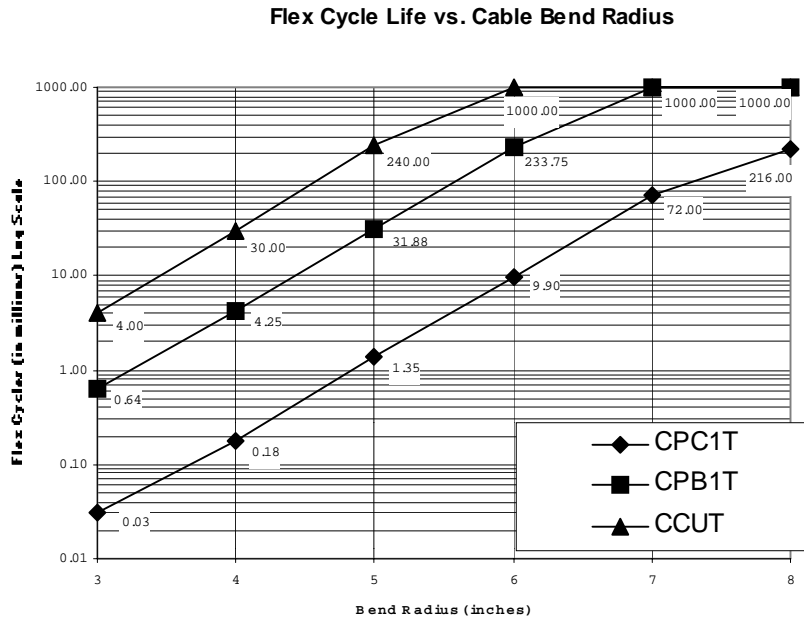
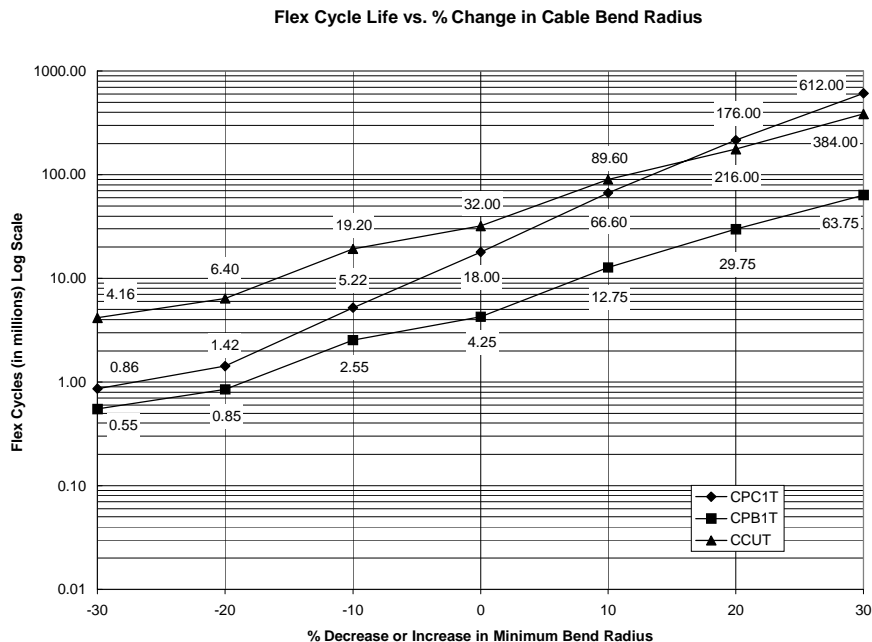


Figure 8.57
Flex Cycle Life vs. % Change in Cable Bend Radius



1326AB and 1326AS Servo Motor Cable Specifications

The following section contains the specifications for the 1326AB and 1326AS motor power, auxiliary feedback, and motor feedback cables.

Motor Power, Feedback and Auxiliary Feedback Cable Specifications

Cable	Description	Specifications			
		Rating ° C (° F)	Shield Coverage	Jacket Material	Weight kg/m (oz/ft)
1326-CPB1-xxx	Motor Power Cable	90° C (194° F)	85%, Braided	Thermoplastic Elastomer	0.25 (2.723)
1326-CPC1-xxx	Motor Power Cable	90° C (194° F)	85%, Braided	Thermoplastic Elastomer	0.45 (4.825)
1326-CPB1T-xxx	Motor Power Cable	80° C (176° F)	95%, Spiral	Polyurethane	0.22 (2.321)
1326-CPC1T-xxx	Motor Power Cable	80° C (176° F)	95%, Spiral	Polyurethane	0.5 (5.33)
1326-CCU-xxx	Motor Feedback Cable	90° C (194° F)	100% Polyester, 85%, Braided	Thermoplastic Elastomer	0.16 (1.68)
1326-CCUT-xxx	Motor Feedback Cable	80° C (176° F)	95%, Spiral	Polyurethane	0.17 (1.785)
1326-CECU-xxx	Auxiliary Feedback Cable	90° C (194° F)	100% Polyester, 85%, Braided	Thermoplastic Elastomer	0.11 (0.01)
1326-CECUT-xxx	Auxiliary Feedback Cable	90° C (194° F)	95%, Spiral	Polyurethane	0.16 (1.68)

1326 Connection Solutions with 1394 System Modules

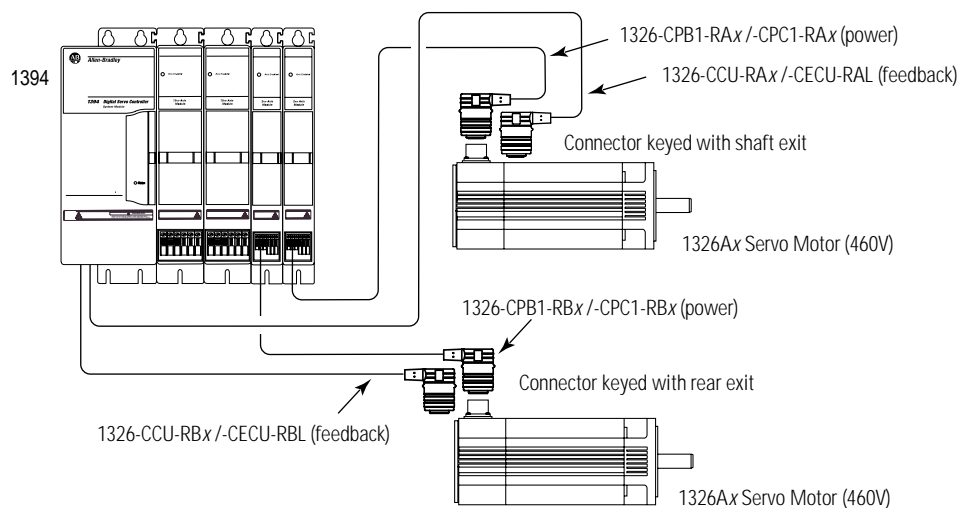
Several accessories are available with 460 volt 1326 cables. This section highlights the most common application used with each accessory, including:

- Right-angle connection
- CE-compliant in-line connection
- Remote in-line connection
- Harsh environment connection
- Double-ended bulkhead in-line connection

Right-Angle Connection

This solution provides a low-profile right-angle connection at the motor.

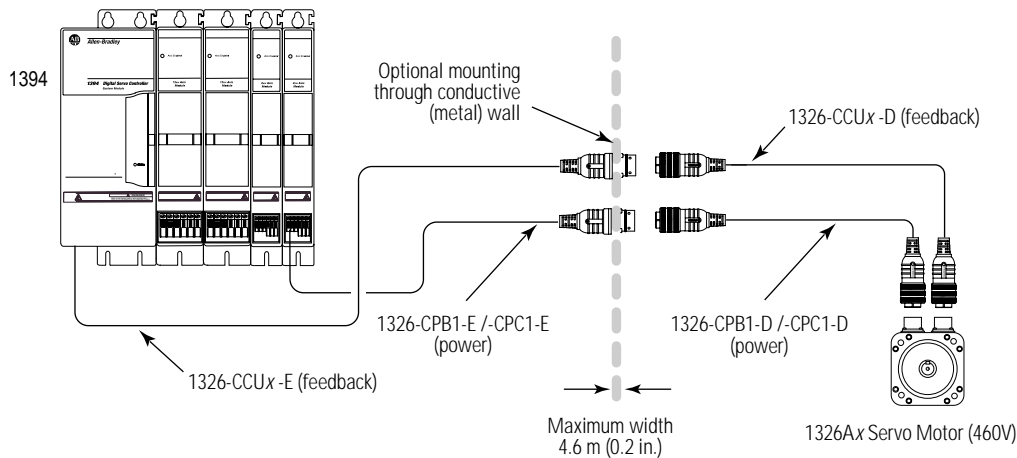
Figure 8.58
Right-Angle Connector Cables



CE-Compliant In-Line Connection

This solution allows for a quick connect or disconnect at the cabinet wall while meeting CE requirements. Link bulkhead and double-ended cables to create an interconnect in a single cable run.

Figure 8.59
Bulkhead and Double-Ended Connector Cables



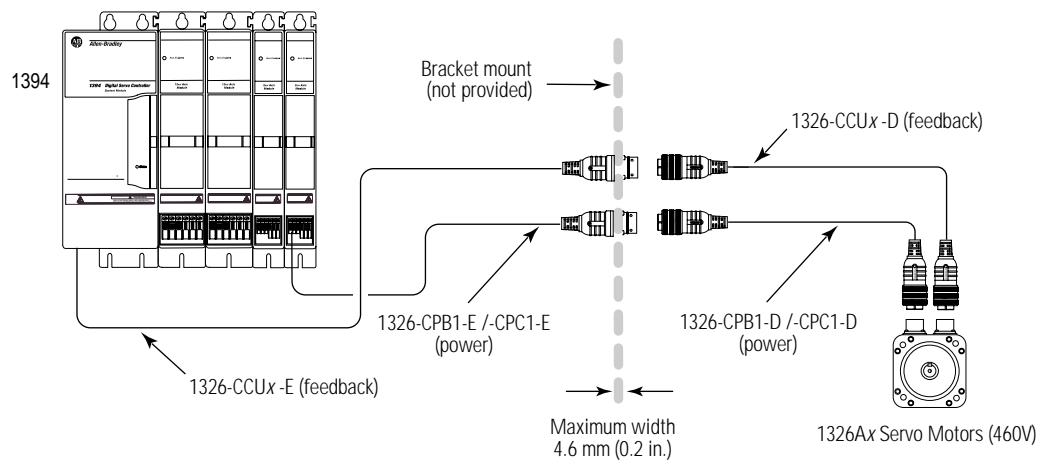
IMPORTANT

To avoid control performance problems ensure the overall length of cable combinations (system/axis module to motor) does not exceed 90 m (295.5 ft).

Remote In-Line Connection

This solution provides a connection outside of a cabinet that uses flex and nonflex cables together for cost reduction.

Figure 8.60
Remote Bulkhead Connection



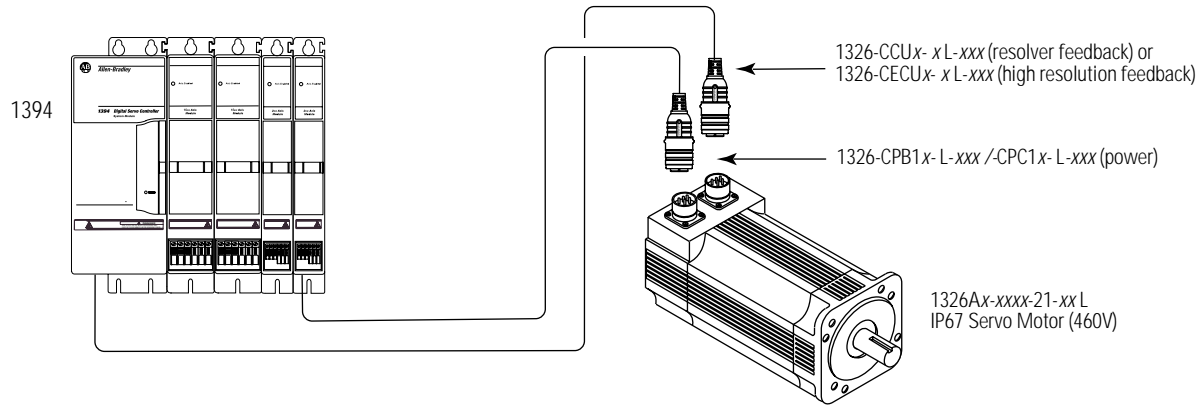
IMPORTANT

To avoid control performance problems ensure the overall length of cable combinations (system/axis module to motor) does not exceed 90 m (295.5 ft).

Harsh Environment Connection

Use the IP67 cable (with the -L option) with an L motor for harsh environments.

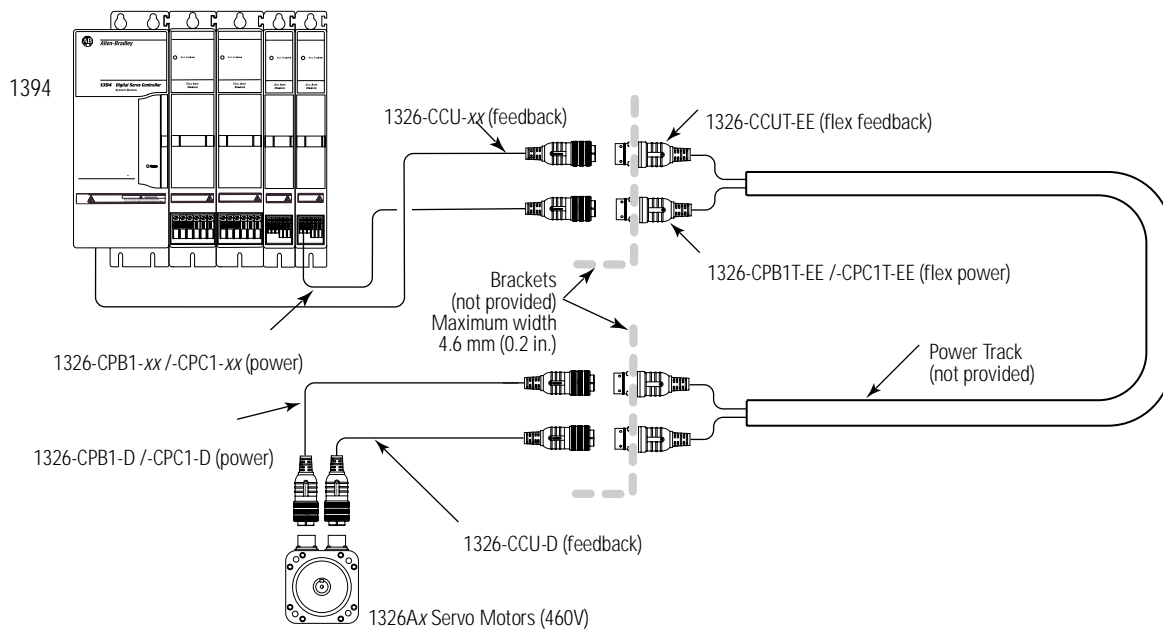
Figure 8.61
Harsh Environment Connection



Double-Ended Bulkhead In-Line Connection

This solution combines flex and nonflex cables for a single run. Shown below are two disconnects in a single cable run with a double-ended bulkhead, a double-ended standard, and a standard cable.

Figure 8.62
Standard, Double-Ended Bulkhead, and Double-Ended Cable for In-Line Connection to Flex Track



IMPORTANT

To avoid control performance problems ensure the overall length of cable combinations (system/axis module to motor) does not exceed 90 m (295.5 ft).

Linear-flex is defined as flex in one direction. The flex-rated cable is not rated for twist-flex, which is flex in two directions. Power track (linear-flex) cabling must not be used in twist applications.

Standard Allen-Bradley cables (1326-CCU-*xxx* for commutation and 1326-CPB1-*xxx* or 1326-CPC1-*xxx* for power) are tray-rated (stationary) and should only be used for one-time flex applications.

Power track cabling is required for applications where dynamic linear flexing occurs. Use the following cables for these applications:

- 1326-CECUT-*xxx* (commutation for -M*x* and -S*x* motors)
- 1326-CCUT-*xxx* (commutation for all resolver motors)
- 1326-CPB1T-*xxx* (power for 1326AB-B4/B5*xxxx* and 1326AS-B3/B4*xxxx* motors)
- 1326-CPC1T-*xxx* (power for 1326AB-B7*xxxx* and 1326AS-B6/B8*xxxx* motors)

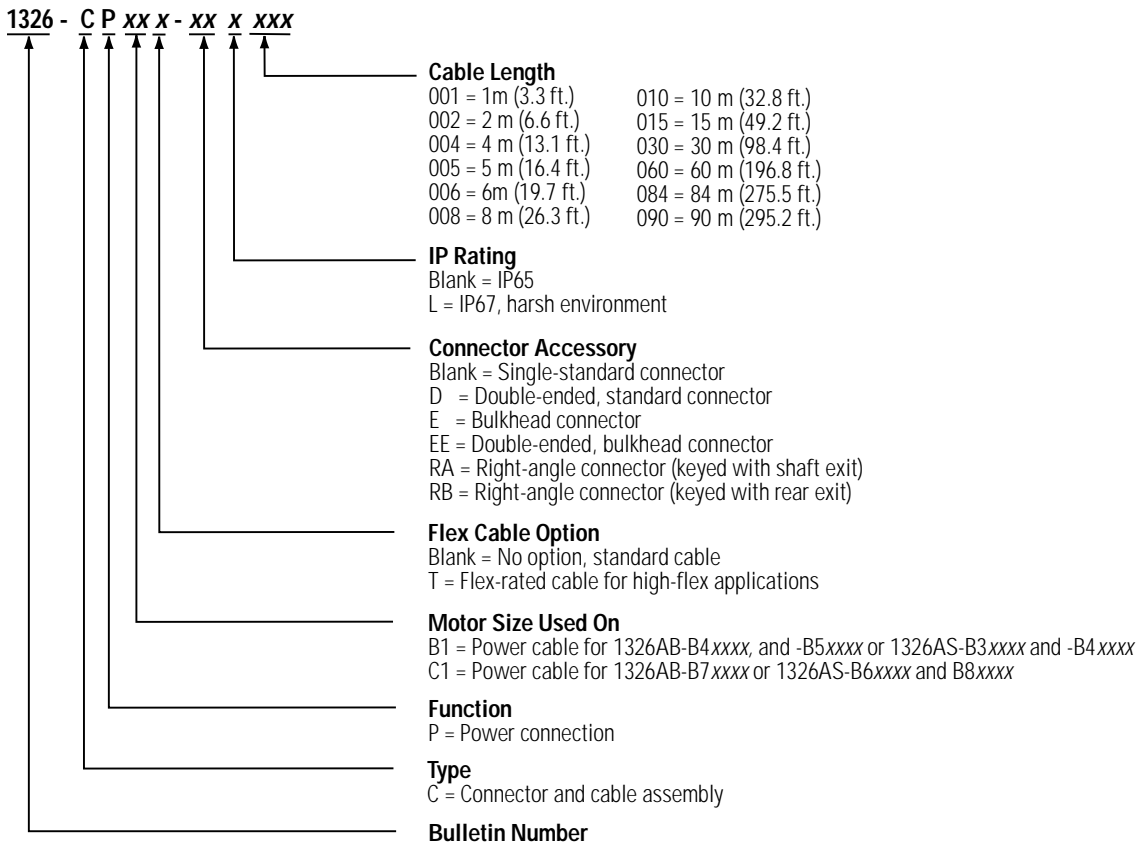
Allen-Bradley high-flex cables have excellent minimum bend radius specifications and a long flex cycle life in linear flex applications. The cycle life of linear-flex cable is directly related to the cable's bend radius in the power track. Refer to Figure 8.56 and Figure 8.57 on the following page for bend radius vs. cycle life specifications.

1326AB and 1326AS Servo Motor Catalog Numbers

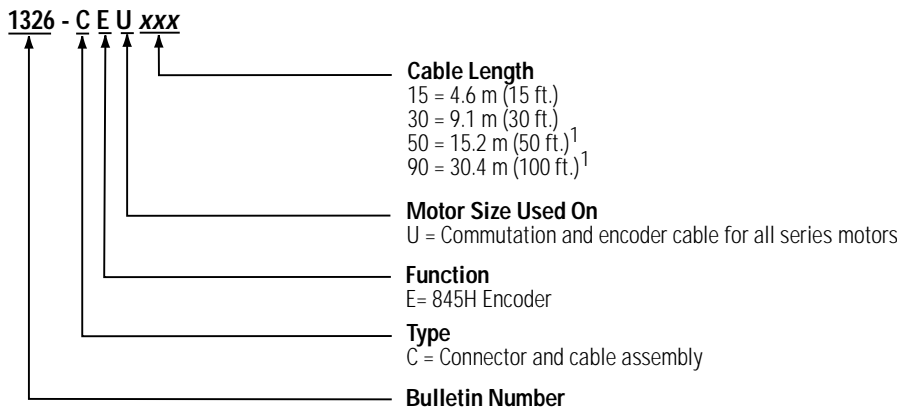
The following sections contain the 1326AB and 1326AS motor power and feedback cable catalog numbers.

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering charts below to understand the configuration of your cables. For questions regarding product availability, contact your Allen-Bradley distributor.

Motor Power Cables

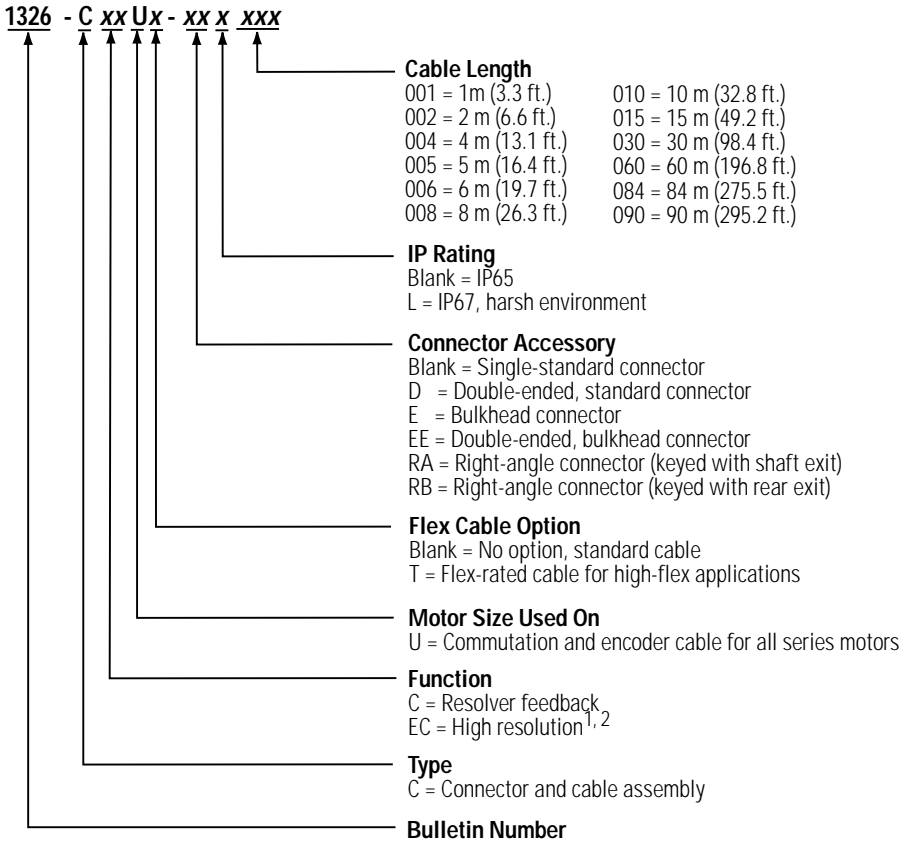


Auxiliary Feedback Cables



¹ Recommended for use with 12V encoders only.

Motor Feedback Cables



¹ For use with 1326AB-Bxxxx-Mx motors only.
² For use with 1394x-xx-x-L drives only.

1326 Motor Cable Pin-outs

The following sections contain cable pin-outs for the 1326AB and 1326AS motor power and feedback cables (1326AB/AS motor to 1394 system/axis module).

1326 Motor Feedback Cables to 1394 System Modules

1326-CCU-xxx Standard Commutation Cable for Motor Resolver						
Pair	Wire Color	Description	Gauge mm ² (AWG)	Connector Pin	System Module Terminal # 1394C-SJTxx-D	System Module Terminal # 1394x-SJTxx-x (except -D)
1	Black	R1	0.5 (20)	A	10	1
	White	R2	0.5 (20)	B	11	6
		Shield	N/A	no connection	Cable Clamp	2
	Black	S1	0.5 (20)	D	3	3
	Red	S3	0.5 (20)	E	4	8
		Shield	N/A	no connection	Cable Clamp	7
	Green	S2	0.5 (20)	G	1	9
	Black	S4	0.5 (20)	H	2	4
		Shield	N/A	no connection	Cable Clamp	5
		Overall Shield	N/A	no connection	Cable Clamp	10

1326-CCUT-xxx Flex Rated Commutation Cable for Motor Resolver						
Pair	Wire Color	Description	Gauge mm ² (AWG)	Connector Pin	System Module Terminal # 1394C-SJTxx-D	System Module Terminal # 1394x-SJTxx-x (except -D)
1	White/Black	R1	0.5 (20)	A	10	1
	White	R2	0.5 (20)	B	11	6
		Shield	NA	no connection	Cable Clamp	2
2	White/Black	S1	0.5 (20)	D	3	3
	White/Red	S3	0.5 (20)	E	4	8
		Shield	NA	no connection	Cable Clamp	7
3	White/Green	S2	0.5 (20)	G	1	4
	White/Black	S4	0.5 (20)	H	2	9
		Shield	0.5 (20)	no connection	Cable Clamp	5
		Green/Yellow	N/A	no connection	Cable Clamp	10

1326-CEU-xxx Quadrature Encoder Cable

Pair	Wire Color	Description		Gauge mm ² (AWG)	Connector Pin	System Module Terminal # 1394C-SJTxx-D
		Encoder	1394 Drive			
1	Black	A (NOT)	AM-	0.34 (22)	H	2
	White	A	AM+	0.34 (22)	A	1
		Shield	Shield	N/A	no connection	Cable Clamp
2	Black	COMMON	COMMON	0.34 (22)	F	5
	Red	+5V DC	+5V DC	0.34 (22)	D	7
		Shield	Shield	N/A	no connection	Cable Clamp
3	Black	Z (NOT)	IM-	0.34 (22)	J	9
	Orange	Z	IM+	0.34 (22)	C	8
		Shield	Shield	N/A	no connection	Cable Clamp
4	Black	B (NOT)	BM-	0.34 (22)	I	4
	Blue	B	BM+	0.34 (22)	B	3
		Shield	Shield	N/A	no connection	Cable Clamp
5	Black	COMMON	COMMON	0.34 (22)	F	5
	Green	no connection	no connection	0.34 (22)	E	Cable Clamp
		Overall Shield	Overall Shield	N/A	G	Cable Clamp

1326 Motor Power Cables to 1394 System Modules

1326-CPB1-xxx Standard Motor Power Cable				
Wire Number/Color	Description	Gauge mm ² (AWG)	Connector Pin	Axis Module Terminal # 1394C-AMxx
1 / Black	Power (T1)	1.5 (16)	1	U1
2 / Black	Power (T2)		2	V1
3 / Black	Power (T3)		3	W1
4 / Black	Brake (B2)	1.5 (16)	4	TB1-3
5 / Black	Thermostat (K1)	1.5 (16)	5	TB1-2
6 / Black	Brake (B1)	1.5 (16)	6	TB1-4
Braided shield	Overall shield	N/A	7	Cable Clamp
Green/Yellow	Ground	1.5 (16)	8	PE2
9 / Black	Thermostat (K2)	1.5 (16)	9	TB1-1

Note: The wiring information in this table applies only to 1326AS-B3xxxx, 1326-AB/AS-B4xxxx and 1326AB-B5xxxx servo motors.

1326-CPB1T-xxx Flex Rated Motor Power Cable				
Wire Color	Description	Gauge mm ² (AWG)	Connector Pin	Axis Module Terminal # 1394C-AMxx
1 / White	Power (T1)	1.5 (16)	1	U1
2 / White	Power (T2)		2	V1
3 / White	Power (T3)		3	W1
4 / White	Brake (B2)	1.5 (16)	4	TB1-3
5 / White	Thermostat (K1)	1.5 (16)	5	TB1-2
6 / White	Brake (B1)	1.5 (16)	6	TB1-4
Braided Shield	Overall shield	N/A	7	Cable Clamp
Green/Yellow	Ground	1.5 (16)	8	PE2
9 / White	Thermostat (K2)	1.5 (16)	9	TB1-1

Note: The wiring information in this table applies only to 1326AS-B3xxxx, 1326-AB/AS-B4xxxx and 1326AB-B5xxxx servo motors.

1326-CPC1-xxx Standard Motor Power Cable

Wire Color	Description	Gauge mm ² (AWG)	Connector Pin	Axis Module Terminal # 1394C-AMxx
1 / Black	Power (T1)	6.0 (10)	1	U1
2 / Black	Power (T2)		2	V1
3 / Black	Power (T3)		3	W1
4 / Black	Brake (B2)	1.5 (16)	4	TB1-3
5 / Black	Thermostat (K1)	1.5 (16)	5	TB1-2
6 / Black	Brake (B1)	1.5 (16)	6	TB1-4
Braided shield	Overall shield	N/A	7	Cable Clamp
Green/Yellow	Ground	4.0 (12)	8	PE2
9 / Black	Thermostat (K2)	1.5 (16)	9	TB1-1

Note: The wiring information in this table applies only to 1326AS-B6xxxx, 1326AS-B8xxxx, and 1326AB-B7xxxx servo motors.

1326-CPC1T-xxx Flex Rated Motor Power Cable

Wire Color	Description	Gauge mm ² (AWG)	Connector Pin	Axis Module Terminal # 1394C-AMxx
1 / White	Power (T1)	6.0 (10)	1	U1
2 / White	Power (T2)		2	V1
3 / White	Power (T3)		3	W1
4 / White	Brake (B2)	1.5 (16)	4	TB1-3
5 / White	Thermostat (K1)	1.5 (16)	5	TB1-2
6 / White	Brake (B1)	1.5 (16)	6	TB1-4
Braided Shield	Overall shield	N/A	7	Cable Clamp
Green/Yellow	Ground	4.0 (12)	8	PE2
9 / White	Thermostat (K2)	1.5 (16)	9	TB1-1

Note: The wiring information in this table applies only to 1326AS-B6xxxx, 1326AS-B8xxxx, and 1326AB-B7xxxx servo motors.

1326AB Motor Feedback Mounting Adapters for 1394 Family

The following section contains configuration diagrams and catalog numbers for the feedback mounting adapters available for 1326AB servo motors.

IMPORTANT

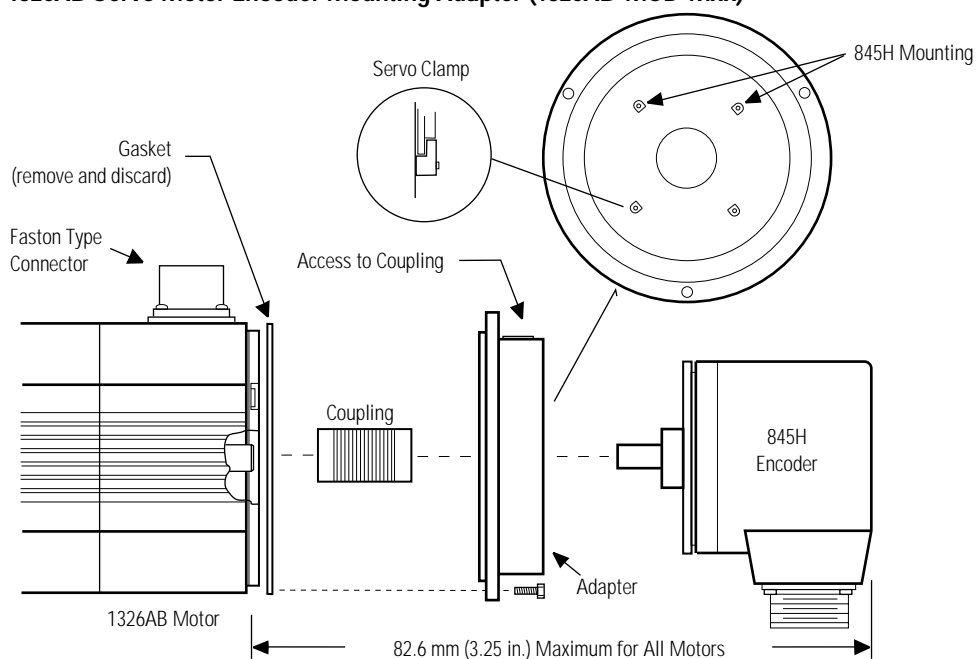
These adapters are not available for high-resolution feedback (-M2, -M1, and -S2) motors.

IMPORTANT

Motors with IP65 or IP67 protection lose their rating when this option is used.

Figure 8.63

1326AB Servo Motor Encoder Mounting Adapter (1326AB-MOD-Mxx)



Note: Use servo clamps to mount an 845H servo mount encoder to the adapter plate.

Note: Coupling accommodates 9.53 mm (0.375 in.) encoder shaft.

Note: Servo clamps accommodate both English and metric servo encoder mounting configurations.

ATTENTION

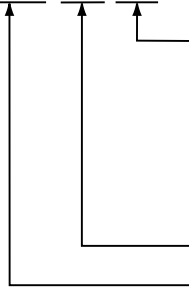
To avoid equipment damage caused by the gasket after adapter installation, remove and discard gasket during disassembly.



1326AB Series Motor Feedback Mounting Adapter Kits Catalog Number

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your feedback mounting adapter kit(s). For questions regarding product availability, contact your Allen-Bradley distributor.

1326AB-MOD-Mxx



Encoder Option

M40 = Allen-Bradley 845H Encoder for the B4 series motor
M50 = Allen-Bradley 845H Encoder for the B5 series motor
M60 = Allen-Bradley 845H Encoder for the B7 series motor
M42 = Allen-Bradley 842A-31 Encoder for the B4 series motor
M52 = Allen-Bradley 842A-31 Encoder for the B5 series motor
M72 = Allen-Bradley 842A-31 Encoder for the B7 series motor

MOD = Modification Kit

Bulletin Number

Note: All kits contain a feedback mounting adapter, mounting hardware, and a coupling. The kit does not contain a feedback device.

Note: Do not use this kit with the high resolution encoder feedback option.

1326AB and 1326AS Motor Junction Box Kits for 1394 Family

The following sections contain descriptions, configuration diagrams, dimensions and catalog numbers for the 1326AB and 1326AS motor junction box kits.

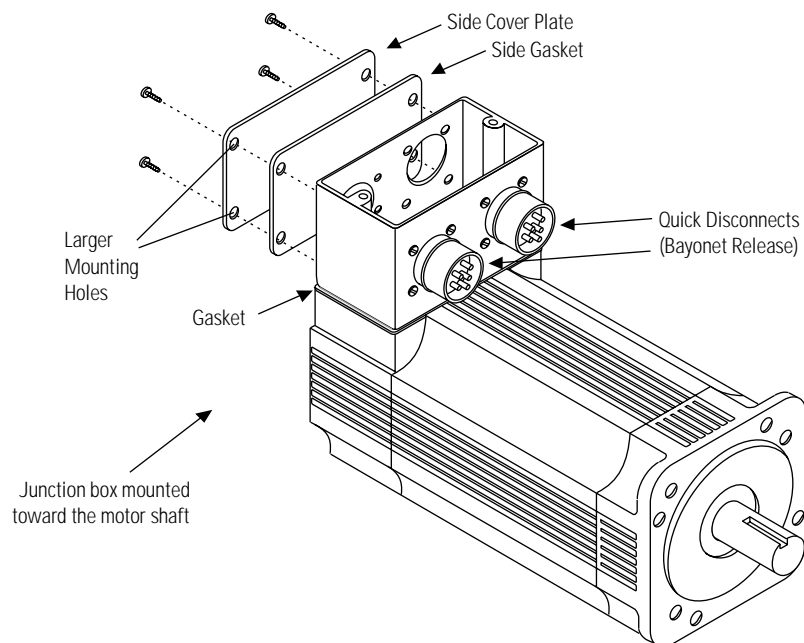
1326AB Motor Junction Box Kits

The Motor Junction Box Kit provides axially-mounted connectors with either front or rear exit connections. The junction box allows the motor connectors to be brought out axially to the motor without further wiring. Motors with IP65 protection maintain their rating when using this option. Refer to the figure below for junction box dimensions.

IMPORTANT

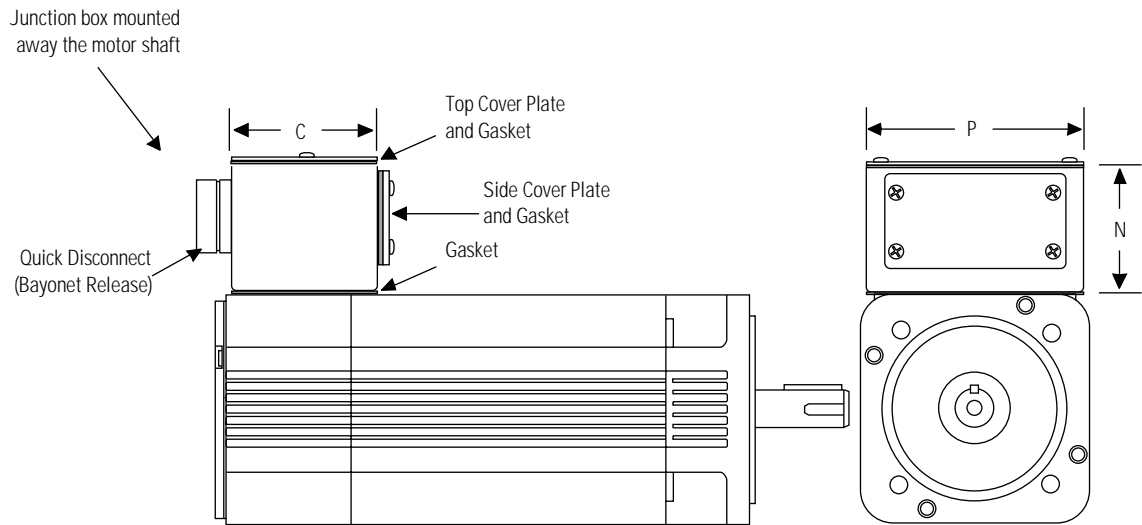
Motors with IP67 protection lose their rating when this option is used.

Figure 8.64
1326AB Servo Motor Junction Box Configuration Diagram (1326AB-MOD-RJxx1)



1326AB Motion Junction Box Dimensions

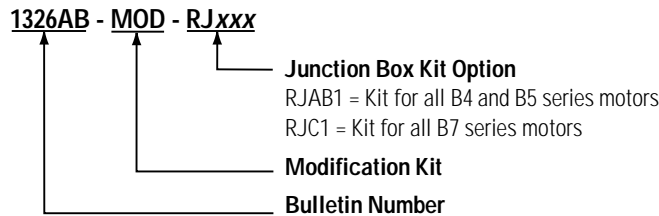
Figure 8.65
1326AB Servo Motor Junction Box Dimensions (1326AB-MOD-RJxx1)



Kit 1326AB-MOD-	C mm (in.)	P mm (in.)	N mm (in.)
RJAB1	63.5 (2.5)	105 (4.13)	62 (2.44)
RJC1	66.675 (2.625)	120.65 (4.75)	66.675 (2.625)

1326AB Series Motor Junction Box Catalog Number

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your motor junction box kit. For questions regarding product availability, contact your Allen-Bradley distributor.



Note: The motor comes standard with IP65 plug style connectors mounted radially to the motor. This kit allows the connectors to be brought out axially to the motor without further wiring. Kit includes a motor junction box and mounting hardware.

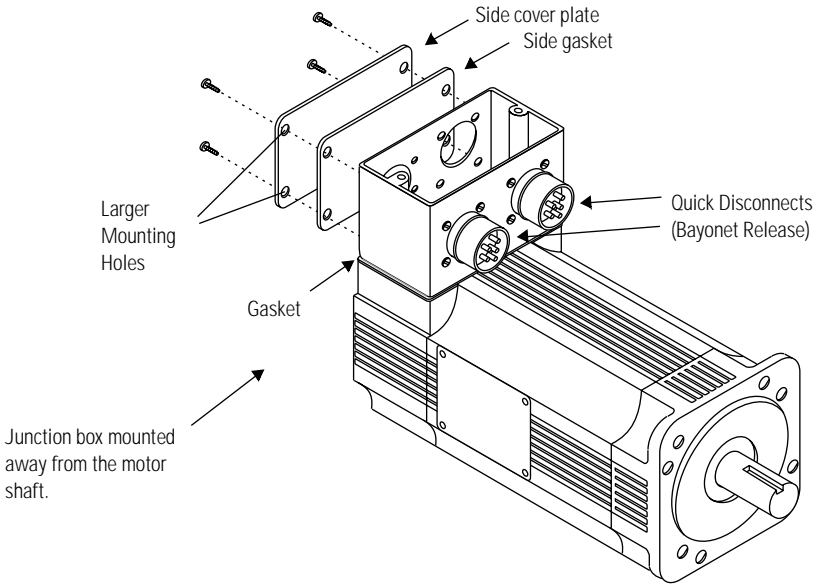
Note: Do not use this kit with the high resolution encoder option. Instead, use the right angle connector cable option.

1326AS Series Motor Junction Box Kit

The 1326AS motor junction box kit allows the existing motor connectors to be mounted axially (rather than radially) without further wiring. Motors with IP65 protection maintain their rating when using this option.

Note: The connector may be mounted to the face or rear of the motor.

Figure 8.66
1326AS Servo Motor Junction Box Configuration (1326AS-RJ34)

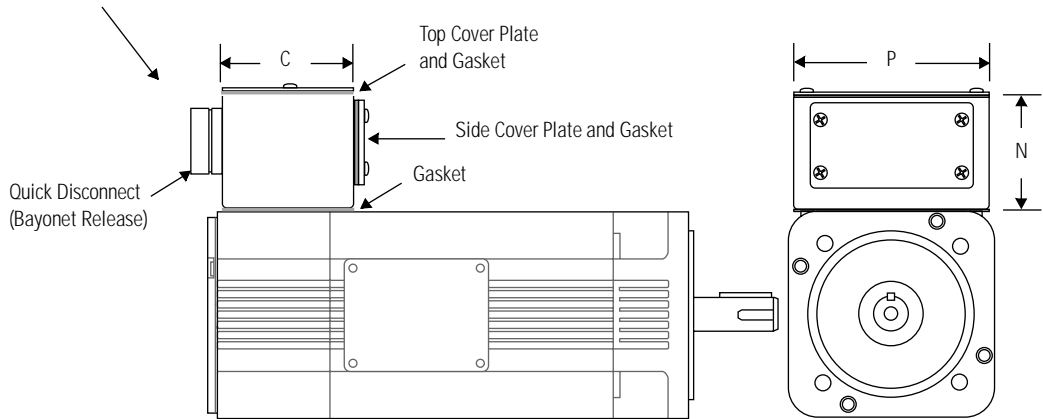


Motor Junction Box Dimensions

Figure 8.67
1326AS Servo Motor Junction Box Dimensions (1326AS-RJ34)

Junction box mounted away from the motor shaft

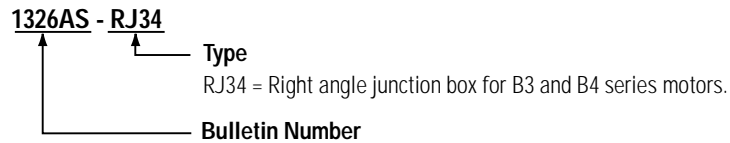
Dimensions are in millimeters (inches).



Kit	C mm (in.)	P mm (in.)	N mm (in.)
1326AB-MOD-			
RJAB1	63.5 (2.5)	105 (4.13)	62 (2.44)
RJC1	66.675 (2.625)	120.65 (4.75)	66.675 (2.625)

1326AS Series Motor Junction Box Kit¹ Catalog Number

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your motor junction box kit. For questions regarding product availability, contact your Allen-Bradley distributor.



¹ The motor comes standard with IP65 plug style connectors mounted radially to the motor. This kit allows the connectors to be brought out axially to the motor without further wiring. Kit includes a motor junction box and mounting hardware.

1394 Motion Control System Motor Shaft Seal Kits

The following section contains motor shaft seal kit descriptions and catalog numbers for the 1326AB and 1326AS servo motors used as part of a 1394 motion control system.

1326AB Series Motor Shaft Seal Kit

Allen-Bradley offers a Viton shaft oil seal kit that you can install on a motor in the field. Use the seal in applications where the motor shaft may be subjected to occasional oil splashes or low pressure water jetting. An example would be when a motor is exposed to splashing from coolant nozzles.

IMPORTANT

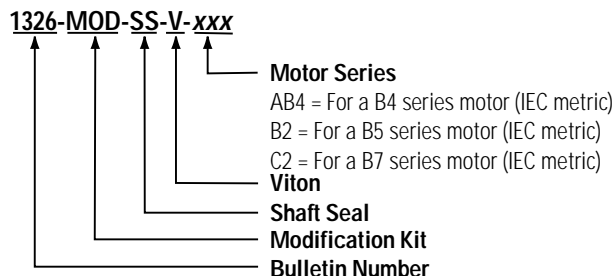
A shaft seal kit must be installed on the motor to meet IP65 requirements. The kit is not intended to be used in applications where the motor shaft is partially or fully submerged in oil.

IMPORTANT

The IP67 motor option (-L) has a factory-installed shaft seal and does not require this kit option.

1326AB Series Motor Shaft Seal Kit Catalog Number

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your motor shaft seal kit. For questions regarding product availability, contact your Allen-Bradley distributor.



1326AS Series Motor Shaft Seal Kit

Allen-Bradley offers a Nitrile shaft oil seal kit that you can install on the motor shaft in the field. Use the seal in applications where the motor shaft may be subjected to occasional oil splashes or low pressure water jetting (For example: If the motor is exposed to splashing from coolant nozzles).

IMPORTANT

The Servo Motor Performance Data section provides system ratings for specific motor/amplifier combinations.

IMPORTANT

The kit is not intended to be used in applications where the motor shaft is partially or fully submerged in oil.

1326AS Series Motor Shaft Seal Kit Catalog Number

Catalog numbers consist of various characters, each of which identifies a specific version or option for that component. Use the catalog numbering chart below to understand the configuration of your motor shaft oil seal kit. For questions regarding product availability, contact your Allen-Bradley distributor.

0041 - 50xx

Series

5065 = Nitrile shaft seal for 1326AS-B3xx motors
5066 = Nitrile shaft seal for 1326AS-B4xx motors
5067 = Nitrile shaft seal for 1326AS-B6xx motors
5053-005 = Nitrile shaft seal for 1326AS-B8xx motors

Bulletin Number

1394 Miscellaneous Accessories

This section contains miscellaneous accessories for the 1394 system family.

Accessory	A-B Catalog Number	Manufacturer's Number
Feedback and I/O connector kit for 1394C-SJTxx-D	1394C-CCK-D	N/A
SERCOS fiber cable bulkhead adaptor (2 per pack)	2090-S-BLHD	N/A
SERCOS fiber cable plastic connector kit	2090-S-TOOLKIT	N/A
SERCOS fiber cable connectors, for plastic cable (20 ea.)	2090-S-CONNECTOR	N/A
Brake and thermal axis connector kit	1394-199	N/A
Cable ground clamp kit	1394C-GCLAMP	N/A
1394-CCFK resolver feedback connector kit, (includes the connector, pins, and extraction tool to connect to 1326-CCU-xxx motor feedback cables). It does not apply to 1394-SJTxx-D.	1394-CCFK	N/A
Brake and thermal connector operating tool	N/A	Wago 231-304
Kit, fuse, for 1394-SR10A (5 and 10 kW system modules)	1394-SR10A-FUSE-A	Bussmann FWP-40A14F
Kit, fuse, for 1394-SR9A (Series B)	1394-SR9A-FUSE-B	Bussmann FWP-50A14F
Kit, fuse, for 1394-SR9AF (Series B)	1394-SR9AF-FUSE-B	
Kit, fuse, for 1394-SR36A (Series B)	1394-SR36A-FUSE-B	
Kit, fuse, for 1394-SR36AF (Series B)	1394-SR36AF-FUSE-B	

Numerics

- 1326 connection solutions
 - 1394 system modules 8-50
- 1326AB Series motors 6-62
 - catalog number 6-74
 - constant specifications 6-67
 - dimensions 6-69
 - feedback adapter kit catalog number 8-61
 - feedback mounting adapters 8-60
 - feedback options 6-62
 - general specifications 6-64
 - integral holding brake 6-73
 - junction box catalog number 8-63
 - junction box dimensions 8-63
 - junction box kits 8-62
 - load force ratings 6-72
 - mechanical specifications 6-66
 - motor options 6-63
 - mounting bolt specifications 6-68
 - performance specifications 6-64
 - shaft seal kit 8-65
 - shaft seal kit catalog number 8-65
 - storage and operating specifications 6-68
 - thermostat specifications 6-68
 - winding specifications 6-67
- 1326AB/1326AS Series motors
 - auxiliary feedback catalog numbers 8-54
 - cable bend radius 8-48
 - cable catalog numbers 8-54
 - cable pin-outs 8-56
 - cable specifications 8-49
 - cables 8-44
 - junction box kits 8-62
 - motor feedback catalog numbers 8-55
 - power and feedback cable dimensions 8-45
 - power and feedback cable specifications 8-49
 - power and feedback cables 8-44
 - power cables catalog numbers 8-54
- 1326AS Series motors 6-75
 - catalog number 6-86
 - constant specifications 6-79
 - dimensions 6-80
 - general specifications 6-77
 - integral holding brake 6-85
 - junction box dimensions 8-64
 - junction box kit catalog number 8-65
 - junction box kits 8-64
 - load force ratings 6-84
 - mechanical specifications 6-78
 - motor options 6-76
 - mounting bolt specifications 6-79
 - performance specifications 6-77
 - shaft seal kit 8-66
 - shaft seal kit catalog number 8-66
 - storage and operating specifications 6-79
 - thermostat specifications 6-79
 - winding specifications 6-78
- 1394
 - 1326AB motors system combinations 7-20
 - 1326AS motors system combinations 7-26
 - 460V MP-Series system combinations 7-17
 - 9/Series CNC interface architecture 4-21
 - ac line filters 8-32
 - ac line filters dimensions 8-33
 - ac line filters specifications 8-32
 - analog servo system architecture 4-22
 - axis module series information 4-10
 - axis modules 4-10
 - axis modules catalog number 4-16
 - axis modules dimensions 4-14
 - axis modules specifications 4-11
 - axislink specifications 4-32
 - DC link module 4-13
 - DC link module dimensions 4-14
 - DC link module power dissipation 4-25
 - DC link module specifications 4-13
 - DH-485 specifications 4-29
 - drive interface module 4-12
 - drive interface module dimensions 4-14
 - drive interface module specifications 4-12
 - drive system family architecture 4-18
 - encoder output specifications 4-30
 - environmental specifications 4-23
 - external shunt kit and modules 8-34
 - external shunt module for 22 kW system 4-26
 - external shunt modules 4-17
 - flex I/O specifications 4-29
 - general system specifications 4-23
 - GMC system architectural overview 4-18
 - GMC system specifications 4-30
 - input transformer specifications (24V) 4-24
 - miscellaneous accessories 8-67
 - miscellaneous specifications 4-27
 - power dissipation - external shunt resistor 4-26
 - power dissipation - internal shunt resistor 4-26
 - power dissipation specifications 4-25
 - relay contact specifications 4-23
 - remote I/O adapter specifications 4-31
 - SERCOS interface system architecture 4-20
 - SERCOS dedicated discrete I/O 4-27
 - serial I/O specifications 4-28
 - shunt module fuse replacement data 8-35

- shunt module specifications 8-35
 - shunt modules catalog number (22 kW) 4-18
 - shunt modules catalog numbers 8-38
 - shunt modules dimensions 8-36
 - shunt resistor kit catalog number(5/10 kW) 4-17
 - system module cable catalog numbers 8-31
 - system module cables dimensions 8-29
 - system module cables specifications 8-30
 - system module catalog numbers 4-7
 - system module dimensions 4-5
 - system module encoder input 4-28
 - system module series information 4-2
 - system modules 4-2
 - system modules specifications 4-3
 - system overview for 9/440 4-7
 - system specifications 4-30
 - user-supplied 24V logic input power 4-24
 - user-supplied contactor (M1) 4-23
 - user-supplied input fusing specifications 4-24
 - 1394 drive system family 4-1
 - 1394 general control interface cables
 - catalog number 8-31
 - 1394 system modules
 - 1326 connection solutions 8-50
 - 1756-M02AE servo module
 - cable dimensions 8-8
 - catalog number 1-5
 - environmental specifications 1-5
 - general specifications 1-3
 - input specifications 1-4
 - output specifications 1-5
 - servo loop specifications 1-5
 - specifications 1-3
 - terminal board catalog number 1-6
 - terminal board connection data 1-6
 - 1756-M08SE 8-axis SERCOS interface module
 - catalog number 1-9
 - communication specifications 1-8
 - environmental specifications 1-9
 - fiber-optic specifications 1-8
 - general specifications 1-8
 - specifications 1-8
 - 1784-PM02AE 2-axis softlogix servo card 1-12
 - catalog number 1-14
 - environmental specifications 1-14
 - general specifications 1-13
 - input specifications 1-13
 - output specifications 1-14
 - specifications 1-13
 - termination panel 1-15
 - termination panel wiring connection data 1-15
 - terminal panel dimensions 1-15
 - 1784-PM02AE termination panel
 - catalog number 1-17
 - encoder connections 1-16
 - servo card 2-axis wiring connections 1-16
 - servo card connection 1-15
 - 2098 Ultra family drive systems
 - accessories 8-1
 - 460V MP-Series motors
 - cable catalog numbers 8-43
 - cable dimensions 8-39
 - cable pinouts 8-41
 - cable specifications 8-40
 - cables 8-39
 - feedback cable catalog number 8-43
 - feedback cable dimensions 8-39
 - feedback cable specifications 8-40
 - power cable catalog number 8-43
 - power cable dimensions 8-39
 - power cable specifications 8-40
 - 9/440 CNC
 - system module 4-8
 - system module dimensions 4-5
 - system module specifications 4-4
 - 9/440 high resolution/absolute CNC system module
 - catalog number 4-9
 - 9/440 system module
 - catalog number 4-8
- ## A
- ac line filters
 - 1394 8-32
 - dimensions for Ultra family 8-21
 - Ultra family 8-21
 - accessories
 - 1394 system family 8-29
 - 2098 Ultra family drive systems 8-1
 - analog system module
 - dimensions 4-5
 - architectures
 - 1394 9/Series CNC interface system 4-21
 - 1394 analog servo system 4-22
 - 1394 drive system family 4-18
 - 1394 GMC system 4-18
 - 1394 SERCOS interface system 4-20
 - Ultra3000 digital servo drives 2-2
 - axis and drive
 - configuring 5-4

- axis gains
 - configuring 5-4
- axis modules
 - 1394 4-10
 - power dissipation 4-25
- axislink specifications
 - 1394 4-32

B

- brake connectors
 - F-Series motors 6-11
 - H-Series motors 6-21
 - MP-Series motors 6-41
 - N-Series motors 6-52
- brake specifications and application guidelines
 - F-Series motors 6-9
 - H-Series motors 6-20
 - MP-Series motors 6-40
 - N-Series motors 6-51
 - Y-Series motors 6-59
- break out board cables
 - dimensions for Ultra family 8-17
 - specifications for Ultra family 8-17
- break out board components
 - Ultra family 8-14
- break out board kits
 - Ultra family 8-14
- break out boards
 - dimensions for Ultra family 8-14
 - Ultra family 8-14
- brushless servo motors 6-1

C

- cable bend radius
 - 1326AB/1326AS Series motors 8-48
- cable connection and functionality
 - Ultra family 8-12
- cable specifications
 - Ultra family 8-9
- cables
 - 1326 auxiliary feedback catalog number 8-54
 - 1326 connection solutions with 1394 8-50
 - 1326 motor pinouts 8-56
 - 1326 motors 8-44
 - 1326 cable bend radius 8-48
 - 1326 catalog numbers 8-54
 - 1326 motor feedback catalog number 8-55
 - 1326 power and feedback 8-44
 - 1326 power catalog numbers 8-54
 - 1326 power/feedback specifications 8-49

- 1326 specifications 8-49
- 1394 control interface catalog number 8-31
- 1394 system module cable dimensions 8-29
- 1394 system module cable specifications 8-30
- 1756-M02AE cable dimensions 8-8
- 230V MP-Series power cable dimensions 8-4
- 460V MP-Series catalog numbers 8-43
- 460V MP-Series dimensions 8-39
- 460V MP-Series feedback catalog number 8-43
- 460V MP-Series feedback dimensions 8-39
- 460V MP-Series feedback specifications 8-40
- 460V MP-Series motor cable pinouts 8-41
- 460V MP-Series motors 8-39
- 460V MP-Series power catalog number 8-43
- 460V MP-Series power dimensions 8-39
- 460V MP-Series power specifications 8-40
- 460V MP-Series specifications 8-40
- control interface cable dimensions 8-7
- H/F power cable dimensions (2/3 kW) 8-3
- H/F power cable dimensions (7.5 kW) 8-3
- H/F-Series feedback cable dimensions 8-5
- MP-Series feedback cable dimensions 8-5
- N-Series feedback cable dimensions 8-6
- N-Series power cable dimensions 8-4
- SERCOS interface cable dimensions 8-8
- SERCOS interface catalog number 8-11
- system module cable catalog numbers 8-31
- Ultra breakout board cable specifications 8-17
- Ultra breakout board dimensions 8-17
- Ultra control interface catalog number 8-11
- Ultra family catalog numbers 8-10
- Ultra family connection charts 8-12
- Ultra family connections 8-1
- Ultra family dimensions 8-3
- Ultra family interface cable dimensions 8-7
- Ultra family motor combinations 8-2
- Ultra family specifications 8-9
- Ultra feedback cable specifications 8-9
- Ultra interface cables specifications 8-9
- Ultra motor feedback cable dimensions 8-5
- Ultra power cable dimensions 8-3
- Ultra power cable specifications 8-9
- Ultra power/feedback catalog numbers 8-10
- Ultra serial interface catalog number 8-10
- Y-Series feedback cable dimensions 8-6
- Y-Series power cable dimensions 8-4

- cam editor
 - graph view in RSLogix 5000 5-10
 - grid view in RSLogix 5000 5-10
 - slope view in RSLogix 5000 5-10

- cam profile editor
 - RSLogix 5000 5-9
 - workspace 5-9
- catalog number
 - 1326AB motors 6-74
 - 1326AB feedback mounting adapter kit 8-61
 - 1326AB motors junction box 8-63
 - 1326AB motors shaft seal kit 8-65
 - 1326 auxiliary feedback cables 8-54
 - 1326 motor feedback cables 8-55
 - 1326 motor power cables 8-54
 - 1326 motor cables 8-54
 - 1326AS motors 6-86
 - 1326AS motors shaft seal kit 8-66
 - 1394 axis modules 4-16
 - 1394 general control interface cables 8-31
 - 1394 shunt modules 8-38
 - 1394 shunt modules (22 kW) 4-18
 - 1394 shunt resistor kit(5 and 10 kW) 4-17
 - 1394 system module 4-7
 - 1394 system module cables 8-31
 - 1756-M02AE servo module 1-5
 - 1756-M02AE servo module terminal board 1-6
 - 1756-M08SE SERCOS interface module 1-9
 - 1784-PM02AE termination panel 1-17
 - 460V MP-Series feedback cable 8-43
 - 460V MP-Series power cable 8-43
 - 9/440 hi-res/absolute CNC system module 4-9
 - 9/440 system module 4-8
 - CNC serial drive system module 4-8
 - controllogix single-axis cables 8-31
 - controllogix two-axis prewired cable 8-31
 - F-Series motors 6-12
 - F-Series motors shaft seal kits 8-28
 - GML commander 5-28
 - H-Series motors 6-23
 - H-Series motors shaft seal kits 8-28
 - MP-Series motor cables 8-43
 - MP-Series motors 6-43
 - MP-Series motors shaft seal kits 8-28
 - N-Series motors 6-53
 - N-Series motors shaft seal kits 8-28
 - RSLogix 5000 programming software 5-11
 - SERCOS interface cable 8-11
 - Ultra family breakout board components 8-18
 - Ultra family cables 8-10
 - Ultra family mating connector kit 8-20
 - Ultra family shaft seal kit 8-28
 - Ultra family motor connector kit 8-20
 - Ultra family motor feedback cables 8-10
 - Ultra family power cables 8-10
 - Ultra3000 digital servo drives 2-31
 - Ultraware 5-22
 - Y-Series motors 6-61
 - Y-Series motors shaft seal kits 8-28
- chassis monitor
 - softlogix 1-11
- CNC interface system module
 - dimensions 4-5
- CNC serial drive system module
 - catalog number 4-8
- commissioning Ultra3000 DeviceNet drive
 - Ultraware 5-17
- commissioning Ultra3000 and Ultra5000 drives
 - Ultraware 5-16
- communication specifications
 - 1756-M08SE SERCOS interface module 1-8
- communications
 - host 5-22
- configuring
 - axis and drive 5-4
 - axis and drive using RSLogix 5000 5-4
 - axis gains 5-4
 - axis gains using RSLogix 5000 5-4
- connection data
 - 1756-M02AE servo module terminal board 1-6
- connector data
 - F-Series motors 6-11
 - H-Series motors 6-21
 - MP-Series motors 6-41
 - N-Series motors 6-52
 - Ultra3000 and Ultra3000 indexing drives 2-19
 - Ultra3000 DeviceNet drives 2-27
 - Ultra3000 indexing DeviceNet drives 2-27
 - Ultra3000 SERCOS drive 2-23
 - Ultra5000 intelligent positioning drives 3-8
 - Y-Series motors 6-60
- connector kits
 - Ultra family 8-19
- constant specifications
 - 1326AB Series motors 6-67
 - 1326AS Series motors 6-79
- control interface cable
 - dimensions 8-7
 - Ultra family catalog number 8-11
- control organizer window
 - RSLogix 5000 5-3

- control setting functions
 - Ultraware motion library commands 5-20
- controller specifications
 - Ultra3000 digital servo drives 2-12
 - Ultra5000 intelligent positioning drives 3-4
- ControlLogix
 - 2-axis prewired cable catalog number 8-31
 - single-axis cable 8-31
 - system overview 1-2
- creating and editing
 - motion application performance profiles 5-9

D

- DC link module
 - 1394 4-13
- dedicated discrete I/O specifications
 - 1394 SERCOS interface system 4-27
- Determining which motor to use 6-1
- developing
 - cam profiles for the Ultra5000 5-18
 - motion control application programs 5-4
- DeviceNet
 - Ultra3000 communication specifications 2-13
 - Ultra3000 digital servo drives 2-6
 - Ultra5000 intelligent positioning drives 3-1
- DeviceNet/indexing DeviceNet with Ultraware
 - Ultra3000 digital servo drives 2-7
- DH-485 specifications
 - 1394 4-29
- diagram explorer
 - GML commander 5-25
- diagram window
 - GML commander 5-26
- digital and analog I/O functions
 - Ultraware motion library commands 5-21
- DIM - drive interface module
 - 1394 4-12
 - dimensions 4-14
 - specifications 4-12
- dimensions
 - 1326 motor cables 8-45
 - 1326AB Series motors 6-69
 - 1326AB Series motors junction box 8-63
 - 1326AS Series motor junction box 8-64
 - 1326AS Series motors 6-80
 - 1394 ac line filters 8-33
 - 1394 axis modules 4-14
 - 1394 DC link module 4-14
 - 1394 shunt modules 8-36
 - 1394 system module 4-5
 - 1394 system module cables 8-29
 - 1756-M02AE servo module cable 8-8
 - 230V MP-Series motors 6-32
 - 230V MP-Series power cable 8-4
 - 460V MP-Series motor cables 8-39
 - 460V MP-Series motor feedback cable 8-39
 - 460V MP-Series motor power cables 8-39
 - 460V MP-Series motors 6-35
 - 9/440 CNC system module 4-5
 - analog system module 4-5
 - breakout boards 8-14
 - CNC interface system module 4-5
 - control interface cable 8-7
 - F-Series motors 6-6
 - F-Series motors shaft seal kits 8-28
 - GMC system module 4-5
 - GMC turbo system module 4-6
 - H/F power cable (2/3 kW) 8-3
 - H/F power cable (7.5 kW) 8-3
 - H/F-Series feedback cables 8-5
 - H-Series motors 6-16
 - H-Series motors shaft seal kits 8-28
 - H-Series power cable 8-3
 - MP-Series feedback cable 8-5
 - MP-Series motors shaft seal kits 8-28
 - N-Series feedback cable 8-6
 - N-Series motors 6-48
 - N-Series motors shaft seal kits 8-28
 - N-Series power cable 8-4
 - SERCOS interface cable 8-8
 - SERCOS interface system module 4-5
 - serial interface cable 8-7
 - Ultra breakout board cables 8-17
 - Ultra motor feedback cables 8-5
 - Ultra motor power cable 8-3
 - Ultra motor shaft seal kits 8-28
 - Ultra shunt resistor kit 8-26
 - Ultra3000 digital servo drives 2-15
 - Ultra5000 intelligent positioning drives 3-6
 - Y-Series feedback cable 8-6
 - Y-Series motors 6-57
 - Y-Series motors shaft seal kits 8-28
 - Y-Series power cable 8-4
- drive function window
 - Ultraware 5-15
- drive set-up
 - Ultraware 5-13

E

- encoder connectors
 - F-Series motors 6-11
 - H-Series motors 6-22
 - MP-Series motors 6-41
 - N-Series motors 6-52
 - Y-Series motors 6-60
- encoder data
 - F-Series motors 6-10
 - H-Series motors 6-21
 - MP-Series motors 6-39
 - N-Series motors 6-51
 - Y-Series motors 6-59
- encoder input specifications
 - 1394 system module 4-28
- encoder output specifications
 - 1394 4-30
- encoder specifications
 - F-Series motors 6-10
 - H-Series motors 6-21
 - MP-Series motors 6-39
 - N-Series motors 6-51
 - Y-Series motors 6-59
- environmental specifications
 - 1394 4-23
 - 1756-M02AE servo module 1-5
 - 1756-M08SE SERCOS interface module 1-9
- external connections
 - Ultra3000 DeviceNet drives 2-27
 - Ultra3000 indexing DeviceNet drives 2-27
 - Ultra3000 SERCOS drive 2-23
 - Ultra3000 standard and indexing drives 2-19
 - Ultra5000 DeviceNet drive 3-11
 - Ultra5000 intelligent positioning drives 3-8
- external shunt kit and modules
 - 1394 8-34
- external shunt modules
 - 1394 4-17

F

- F-4000 Motors
 - NEMA 56C dimensions 6-8
 - supplemental NEMA 56C dimensions 6-8
- feedback cable dimensions
 - H/F-Series motors 8-5
 - MP-Series motors 8-5
 - N-Series motors 8-6
 - Y-Series motors 8-6
- feedback mounting adapters
 - 1326AB Series motors 8-60

- feedback options
 - 1326AB Series motors 6-62
- feedback specifications
 - Ultra3000 digital servo drives 2-14
 - Ultra5000 intelligent positioning drives 3-5
- fiber-optic specifications
 - 1756-M08SE SERCOS interface module 1-8
- flex I/O specifications
 - 1394 4-29
- F-Series motors
 - brake connector 6-11
 - brake specifications/application guidelines 6-9
 - catalog number 6-12
 - connector data 6-11
 - connectors 6-12
 - dimensions 6-6
 - encoder connector 6-11
 - encoder data 6-10
 - encoder specifications 6-10
 - general specifications 6-4
 - load force ratings 6-9
 - mechanical specifications 6-4
 - power connector 6-11
 - shaft seal kit catalog number 8-28
 - shaft seal kit dimensions 8-28
 - shaft seal kits 8-28
 - storage and operating specifications 6-5
 - supplemental dimensions 6-7
 - thermostat specifications 6-5
 - Ultra3000/5000 performance specifications 6-4
 - winding specifications 6-4
 - wire sizing recommendations 6-12

G

- general motor performance definitions 6-87
- general specifications
 - 1326AB Series motors 6-64
 - 1326AS Series motors 6-77
 - 1756-M02AE servo module 1-3
 - 1756-M08SE SERCOS interface module 1-8
 - 230V MP-Series motors 6-26
 - 460V MP-Series motors 6-29
 - F-Series motors 6-4
 - H-Series motors 6-14
 - N-Series motors 6-45
 - Ultra3000 digital servo drives 2-10
 - Ultra5000 intelligent positioning drives 3-3
 - Y-Series motors 6-55
- general system specifications
 - 1394 4-23

GMC

- 1394 system specifications 4-30
- system module dimensions 4-5
- turbo system module dimensions 4-6

GML commander

- catalog number 5-28
- diagram explorer 5-25
- diagram window 5-26
- pc requirements 5-23
- tag explorer 5-26
- tag window 5-27
- terminal window 5-27
- workspace 5-24

graphical trends

- viewing 5-5

H

H/F-Series motors

- feedback cable dimensions 8-5
- power cable dimensions (2 & 3 kW drives) 8-3
- power cable dimensions (7.5 kW drives) 8-3

homing with Ultraware

- Ultra3000 indexing drives 2-4

host communications 5-22

H-Series motors

- brake connector 6-21
- brake specifications/application guidelines 6-20
- catalog number 6-23
- connector data 6-21
- connectors 6-22
- dimensions 6-16
- encoder connector 6-22
- encoder data 6-21
- encoder specifications 6-21
- general specifications 6-14
- H-4000 NEMA 56C dimensions 6-18
- load force ratings 6-19
- mechanical specifications 6-14
- power connector 6-21
- power cable dimensions 8-3
- shaft seal kit catalog number 8-28
- shaft seal kit dimensions 8-28
- shaft seal kits 8-28
- storage and operating specifications 6-15
- supplemental dimensions 6-17
- supplemental H-4000 NEMA dimensions 6-18
- thermostat specifications 6-15
- Ultra3000/5000 performance specifications 6-14
- winding specifications 6-15
- wire sizing recommendations 6-22

H-Series power cable dimensions 8-3

I

indexing drives

- Ultra3000 digital servo drives 2-2

indexing with Ultraware

- Ultra3000 digital servo drives 2-3

input specifications

- 1756-M02AE servo module 1-4

input transformer specifications for 24V power

- 1394 4-24

inputs/outputs specifications

- Ultra3000 digital servo drives 2-12
- Ultra5000 intelligent positioning drives 3-4

instruction example

- RSLogix 5000 5-6

instructions

- motion 5-6
- motion configuration 5-7
- motion event 5-7
- motion group 5-7
- motion move 5-7
- motion state 5-6
- RSLogix 5000 5-6

integral holding brake

- 1326AB Series motors 6-73
- 1326AS Series motors 6-85

interface cables

- Ultra family dimensions 8-7
- Ultra family specifications 8-9

J

junction box kits

- 1326AB Series motors 8-62
- 1326AB/1326AS Series motors 8-62
- 1326AS Series motors 8-64

L

ladder logic programming

- RSLogix 5000 5-8

latch functions

- Ultraware motion library commands 5-22

load force ratings

- 1326AB Series motors 6-72
- 1326AS Series motors 6-84
- F-Series motors 6-9
- H-Series motors 6-19
- MP-Series motors 6-38
- N-Series motors 6-50
- Y-Series motors 6-58

logix 1-1

M

- mating connector kits
 - Ultra family 8-20
- mechanical specifications
 - 1326AB Series motors 6-66
 - 1326AS Series motors 6-78
 - 230V MP-Series motors 6-27
 - 460V MP-Series motors 6-30
 - F-Series motors 6-4
 - H-Series motors 6-14
 - N-Series motors 6-46
 - Y-Series motors 6-55
- miscellaneous specifications
 - 1394 4-27
- motion
 - configuration instructions 5-7
 - event instructions 5-7
 - group instructions 5-7
 - instructions 5-6
 - move instructions 5-7
 - state instructions 5-6
- motion application performance profiles
 - creating and editing 5-9
- motion control accessories 8-1
- motion functions
 - Ultraware motion library commands 5-21
- motion instructions
 - RSLogix 5000 5-6
- motion library commands
 - Ultraware 5-20
- motion program editor
 - Ultraware 5-19
- motor connector kits
 - Ultra family 8-19
- motor feedback cables
 - 1326 catalog number 8-55
 - 1326 dimensions 8-45
 - 1326 specifications 8-49
 - Ultra catalog number 8-10
 - Ultra dimensions 8-5
 - Ultra specifications 8-9
- motor options
 - 1326AB Series motors 6-63
 - 1326AS Series motors 6-76
- motor power cables
 - 1326 catalog number 8-54
 - 1326 dimensions 8-45
 - 1326 specifications 8-49
 - Ultra catalog number 8-10
 - Ultra dimensions 8-3
 - Ultra specifications 8-9
- motors
 - 1326AB-Series 6-62
 - 1326AS-Series 6-75
 - F-Series 6-3
 - H-Series 6-13
 - MP-Series 6-24
 - N-Series 6-44
 - Y-Series 6-54
- mounting bolt specifications
 - 1326AB Series motors 6-68
 - 1326AS Series motors 6-79
- MP-Series motors
 - 230V dimensions 6-32
 - 230V general specifications 6-26
 - 230V mechanical specifications 6-27
 - 230V performance specifications 6-26
 - 230V storage and operating specifications 6-28
 - 230V thermostat specifications 6-28
 - 230V winding specifications 6-27
 - 460V dimensions 6-35
 - 460V general specifications 6-29
 - 460V mechanical specifications 6-30
 - 460V cable catalog numbers 8-43
 - 460V cable dimensions 8-39
 - 460V cable pinouts 8-41
 - 460V cable specifications 8-40
 - 460V cables 8-39
 - 460V feedback cable catalog number 8-43
 - 460V feedback cable dimensions 8-39
 - 460V feedback cable specifications 8-40
 - 460V power cable catalog number 8-43
 - 460V power cable dimensions 8-39
 - 460V power cable specifications 8-40
 - 460V performance specifications 6-29
 - 460V storage and operating specifications 6-31
 - 460V thermostat specifications 6-31
 - 460V winding specifications 6-31
 - axial load force ratings 6-38
 - brake connector 6-41
 - brake specifications/application guidelines 6-40
 - catalog number 6-43
 - connector data 6-41
 - encoder connectors 6-41
 - encoder data 6-39
 - encoder specifications 6-39
 - feedback cable dimensions 8-5
 - load force ratings 6-38
 - options 6-25
 - power cable dimensions 8-4
 - power connector 6-41
 - radial load force ratings 6-38

- shaft seal kit catalog number 8-28
- shaft seal kit dimensions 8-28
- shaft seal kits 8-28
- standard encoder features 6-25
- wire sizing recommendations 6-42

N

- NEMA 56C dimensions
 - F-4000 motors 6-8
 - H-4000 motors 6-18
- non-volatile array functions
 - Ultraware motion library commands 5-22
- N-Series motors
 - brake connector 6-52
 - brake specifications/application guidelines 6-51
 - catalog number 6-53
 - connector data 6-52
 - dimensions 6-48
 - encoder connector 6-52
 - encoder data 6-51
 - encoder specifications 6-51
 - feedback cable dimensions 8-6
 - general specifications 6-45
 - load force ratings 6-50
 - mechanical specifications 6-46
 - power connector 6-52
 - power cable dimensions 8-4
 - shaft seal kit catalog number 8-28
 - shaft seal kit dimensions 8-28
 - shaft seal kits 8-28
 - storage and operating specifications 6-46
 - supplemental dimensions 6-49
 - thermostat specifications 6-47
 - Ultra3000/5000 performance specifications 6-45
 - winding specifications 6-46
 - wire sizing recommendations 6-53

O

- operating modes command sources
 - Ultra3000 digital servo drives 2-13
- output cam editor
 - RSLogix 5000 5-11
- output specifications
 - 1756-M02AE servo module 1-5

P

- pc requirements
 - GML commander 5-23

- RSLogix 5000 5-1
- softlogix 1-10
- Ultraware 5-12
- performance specifications
 - 1326AB Series motors 6-64
 - 1326AS Series motors 6-77
 - 230V MP-Series motors 6-26
 - 460V MP-Series motors 6-29
 - F-Series motors 6-4
 - H-Series motors 6-14
 - N-Series motors 6-45
 - Y-Series motors 6-55
- physical and environmental specifications
 - Ultra3000 digital servo drives 2-11
 - Ultra5000 intelligent positioning drives 3-3
- power and feedback cables
 - 1326AB/1326AS Series motors 8-44
- power cable dimensions
 - H-Series motors 8-3
 - H/F-Series motors for 2 and 3 kW drives 8-3
 - H/F-Series motors for 7.5 kW drives 8-3
 - MP-Series motors 8-4
 - N-Series motors 8-4
 - Y-Series motors 8-4
- power connectors
 - F-Series motors 6-11
 - H-Series motors 6-21
 - MP-Series motors 6-41
 - N-Series motors 6-52
 - Y-Series motors 6-60
- power dissipation
 - 1394 DC link module 4-25
 - 1394 external shunt module (22 kW) 4-26
 - 1394 external shunt resistor (5/10 kW) 4-26
 - 1394 internal shunt resistor (5/10 kW) 4-26
 - 1394-DCLM 4-25
 - axis modules 4-25
 - specifications for 1394 4-25
 - specifications for Ultra3000 2-12
 - specifications for Ultra5000 3-4
 - system modules 4-25
- power input specifications
 - Ultra3000 digital servo drives 2-11
 - Ultra5000 intelligent positioning drives 3-3
- power ratings
 - Ultra3000 digital servo drives 2-9
 - Ultra5000 intelligent positioning drives 3-2
- programming
 - ladder logic 5-8

programming software
 RSLogix 5000 5-1
programming the Ultra5000
 Ultraware 5-19

R

radial load force ratings
 MP-Series motors 6-38
relay contact specifications
 1394 4-23
remote I/O adapter specifications
 1394 4-31
RSLogix 5000
 cam editor graph view 5-10
 cam editor grid view 5-10
 cam editor slope view 5-10
 cam profile editor 5-9
 cam profile editor workspace 5-9
 configuring an axis and drive 5-4
 configuring axis gains 5-4
 control organizer window 5-3
 editing application performance profiles 5-11
 instruction example 5-6
 instructions 5-6
 ladder logic programming 5-8
 motion application performance profiles 5-9
 motion control application program 5-4
 motion instructions 5-6
 output cam editor 5-11
 pc requirements 5-1
 programming Ultra3000 SERCOS drive 2-5
 programming software 5-1
 programming software catalog number 5-11
 viewing graphical trends 5-5
 workspace 5-2

S

SERCOS communication specifications
 Ultra3000 digital servo drive 2-13
SERCOS interface
 Ultra3000 digital servo drive 2-5
SERCOS interface cable
 catalog number 8-11
 dimensions 8-8
 specifications 8-9
SERCOS interface system module
 dimensions 4-5
serial communication port specifications
 Ultra3000 digital servo drives 2-14

serial communications specifications
 Ultra3000 digital servo drives 2-13
serial I/O specifications
 1394 4-28
serial interface cable
 dimensions 8-7
 Ultra family catalog number 8-10
series information
 1394 axis module 4-10
servo loop specifications
 1756-M02AE servo module 1-5
servo module
 1756-M02AE 1-3
set-up and homing with ultraware
 Ultra3000 indexing drives 2-3
shaft seal kits
 1326AB Series motors 8-65
 1326AS Series motors 8-66
 F-Series motors 8-28
 H-Series motors 8-28
 MP-Series motors 8-28
 N-Series motors 8-28
 Ultra family combinations 8-28
 Y-Series motors 8-28
shunt module fuse replacement data
 22 kW 1394 system module 8-35
shunt resistor kits
 Ultra family 8-26
 Ultra family dimensions 8-26
softlogix
 chassis monitor 1-11
 pc requirements for 1-10
 system overview 1-11
specifications
 1326AB/1326AS motor cables 8-49
 1326 power/feedback cable specifications 8-49
 1394 ac line filters 8-32
 1394 axis modules 4-11
 1394 DC link module 4-13
 1394 drive interface module 4-12
 1394 shunt module 8-35
 1394 system module cables 8-30
 1756-M02AE servo module 1-3
 1756-M08SE SERCOS servo module 1-8
 460V MP-Series motor cables 8-40
 460V MP-Series motor feedback cable 8-40
 460V MP-Series motor power cables 8-40
 9/440 CNC system modules 4-4
 SERCOS interface cable 8-9
 Ultra breakout board cables 8-17
 Ultra family cables 8-9

- Ultra feedback cables 8-9
- Ultra interface cables 8-9
- Ultra power cables 8-9
- Ultra3000 digital servo drives 2-10
- Ultra5000 intelligent positioning drives 3-3
- storage and operating specifications
 - 1326AB Series motors 6-68
 - 1326AS Series motors 6-79
 - 230V MP-Series motors 6-28
 - 460V MP-Series motors 6-31
 - F-Series motors 6-5
 - H-Series motors 6-15
 - N-Series motors 6-46
 - Y-Series motors 6-56
- supplemental dimensions
 - F-4000 NEMA 56C motors 6-8
 - F-Series motors 6-7
 - H-4000 NEMA 56C motors 6-18
 - H-Series motors 6-17
 - N-Series motors 6-49
 - Y-Series motors 6-58
- system combinations
 - 1394 with 1326AB-Series motors 7-20
 - 1394 with 1326AS-Series motors 7-26
 - 1394 with 460V MP-Series motors 7-17
 - Ultra3000/5000 with 115V Y-Series motors 7-14
 - Ultra3000/5000 with 230V MP-Series motors 7-7
 - Ultra3000/5000 with 230V Y-Series motors 7-15
 - Ultra3000/5000 with F-Series motors 7-1
 - Ultra3000/5000 with H-Series motors 7-3
 - Ultra3000/5000 with N-Series motors 7-11
- system modules
 - 1394 4-2
 - 1394 series information 4-2
 - 9/440 CNC 4-8
 - catalog numbers 4-7
 - power dissipation 4-25
 - specifications 4-3
- system overview
 - Ultra3000 DeviceNet drive 2-9
 - Ultra3000 digital servo drives 2-8
 - Ultra3000 SERCOS drive 2-8
 - Ultra5000 DeviceNet drive 3-2
 - Ultra5000 intelligent positioning drives 3-2
- system specifications
 - 1394 4-30

T

- tag explorer
 - GML commander 5-26

- tag window
 - GML commander 5-27
- terminal window
 - GML commander 5-27
- thermostat specifications
 - 1326AB Series motors 6-68
 - 1326AS Series motors 6-79
 - 230V MP-Series motors 6-28
 - 460V MP-Series motors 6-31
 - F-Series motors 6-5
 - H-Series motors 6-15
 - N-Series motors 6-47
- torque-speed curves 7-1

U

- Ultra family
 - ac line filters 8-21
 - ac line filters dimensions 8-21
 - break out board cable dimensions 8-17
 - break out board cable specifications 8-17
 - break out component catalog numbers 8-18
 - break out board components 8-14
 - break out board dimensions 8-14
 - break out board kits 8-14
 - break out boards 8-14
 - cable catalog numbers 8-10
 - cable connection and functionality 8-12
 - cable connections 8-1
 - cable dimensions 8-3
 - cable specifications 8-9
 - connector kits 8-19
 - control interface cable catalog number 8-11
 - control interface cable dimensions 8-7
 - interface cable dimensions 8-7
 - interface cable specifications 8-9
 - mating connector kit catalog numbers 8-20
 - mating connector kits 8-20
 - motor connector kit catalog number 8-20
 - motor connector kits 8-19
 - motor feedback cable dimensions 8-5
 - motor feedback cable specifications 8-9
 - motor power cable dimensions 8-3
 - motor power cable specifications 8-9
 - motor shaft seal kit combinations 8-28
 - motor shaft seal kit dimensions 8-28
 - motor shaft seal kits 8-28
 - motor/cable combinations 8-2
 - power/feedback cable catalog numbers 8-10
 - serial interface cable catalog number 8-10
 - shaft seal kit catalog number 8-28

- shunt resistor kit dimensions 8-26
- shunt resistor kits 8-26
- Ultra3000 and Ultra5000
 - 115V Y-Series system combinations 7-14
 - 230V MP-Series performance specifications 6-26
 - 230V MP-Series system combinations 7-7
 - 230V Y-Series system combinations 7-15
 - F-Series performance specifications 6-4
 - F-Series system combinations 7-1
 - H-Series performance specifications 6-14
 - H-Series system combinations 7-3
 - N-Series performance specifications 6-45
 - N-Series system combinations 7-11
 - Y-Series performance specifications 6-55
- Ultra3000 digital servo drives
 - 7.5 and 15 kW dimensions 2-17
 - 15 kW dimensions 2-17
 - 15 kW dimensions 2-18
 - architectures 2-2
 - catalog number 2-31
 - connectors specifications 2-14
 - controller specifications 2-12
 - DeviceNet 2-6
 - DeviceNet connector data 2-27
 - DeviceNet with Ultraware 2-7
 - DeviceNet communication specifications 2-13
 - DeviceNet drive system overview 2-9
 - dimensions 2-15
 - external connections (DeviceNet) 2-27
 - external connections (SERCOS) 2-23
 - external connections (std./indexing) 2-19
 - feedback specifications 2-14
 - general specifications 2-10
 - indexing drives 2-2
 - indexing with Ultraware 2-3
 - inputs/outputs specifications 2-12
 - operating modes command sources 2-13
 - physical and environmental specifications 2-11
 - power dissipation specifications 2-12
 - power input specifications 2-11
 - power ratings 2-9, 3-2
 - RSLogix 5000 for SERCOS drive 2-5
 - SERCOS communication specifications 2-13
 - SERCOS connector data 2-23
 - SERCOS interface 2-5
 - SERCOS/DeviceNet 1/2 kW dimensions 2-16
 - SERCOS/DeviceNet 500W dimensions 2-16
 - SERCOS drive system overview 2-8
 - serial communication port specifications 2-14
 - serial communications specifications 2-13
 - specifications 2-10
 - standard and indexing 1/2 kW dimensions 2-15
 - standard and indexing 500W dimensions 2-15
 - standard and indexing connector data 2-19
 - system overviews 2-8
- Ultra3000 indexing drives
 - homing with ultraware 2-4
 - set-up and homing with ultraware 2-3
- Ultra5000 intelligent positioning drives
 - 1 and 2 kW dimensions 3-6
 - 500W dimensions 3-6
 - connector data 3-8
 - connectors specifications 3-5
 - controller specifications 3-4
 - DeviceNet drive 3-1
 - DeviceNet drive 1 and 2 kW dimensions 3-7
 - DeviceNet drive 500W dimensions 3-7
 - DeviceNet drive external connections 3-11
 - DeviceNet drive system overview 3-2
 - dimensions 3-6
 - external connections 3-8
 - feedback specifications 3-5
 - general specifications 3-3
 - inputs/outputs specifications 3-4
 - physical and environmental specifications 3-3
 - power dissipation specifications 3-4
 - power input specifications 3-3
 - power ratings 3-2
 - specifications 3-3
 - system overview 3-2
- Ultraware
 - catalog number 5-22
 - commissioning Ultra3000 DeviceNet drive 5-17
 - commissioning Ultra3000/5000 drives 5-16
 - developing cam profiles for the Ultra5000 5-18
 - drive function window 5-15
 - drive set-up 5-13
 - motion library commands 5-20
 - motion program editor 5-19
 - pc requirements 5-12
 - programming Ultra5000 5-19
 - user programming specifications 5-20
 - windows 5-15
 - workspace 5-14
- Ultraware motion library commands
 - control setting functions 5-20
 - digital and analog I/O functions 5-21
 - latch functions 5-22
 - motion functions 5-21
 - non-volatile array functions 5-22
- user programming specifications
 - Ultraware 5-20

user-supplied
 24V logic input power specifications 4-24
 contactor (M1) specifications 4-23
 input fusing specifications 4-24

V

viewing
 graphical trends 5-5
viewing graphical trends
 RSLogix 5000 5-5

W

winding specifications
 1326AB Series motors 6-67
 1326AS Series motors 6-78
 230V MP-Series motors 6-27
 460V MP-Series motors 6-31
 F-Series motors 6-4
 H-Series motors 6-15
 N-Series motors 6-46
 Y-Series motors 6-56
windows
 Ultraware 5-15
wire sizing recommendations
 F-Series motors 6-12
 H-Series motors 6-22
 MP-Series motors 6-42
 N-Series motors 6-53
 Y-Series motors 6-61

workspace
 cam profile editor 5-9
 GML commander 5-24
 RSLogix 5000 5-2
 Ultraware 5-14

Y

Y-Series motors
 brake specifications/application guidelines 6-59
 catalog number 6-61
 connector data 6-60
 dimensions 6-57
 encoder connector 6-60
 encoder data 6-59
 encoder specifications 6-59
 feedback cable dimensions 8-6
 general specifications 6-55
 load force ratings 6-58
 mechanical specifications 6-55
 power cable dimensions 8-4
 power connector 6-60
 shaft seal kit catalog number 8-28
 shaft seal kit dimensions 8-28
 shaft seal kits 8-28
 storage and operating specifications 6-56
 supplemental dimensions 6-58
 Ultra3000/5000 performance specifications 6-55
 winding specifications 6-56
 wire sizing recommendations 6-61

For more information refer to our web site: www.ab.com/motion

Reach us now at www.rockwellautomation.com

Wherever you need us, Rockwell Automation brings together leading brands in industrial automation including Allen-Bradley controls, Reliance Electric power transmission products, Dodge mechanical power transmission components, and Rockwell Software. Rockwell Automation's unique, flexible approach to helping customers achieve a competitive advantage is supported by thousands of authorized partners, distributors and system integrators around the world.

Americas Headquarters, 1201 South Second Street, Milwaukee, WI 53204, USA, Tel: (1) 414 382-2000, Fax: (1) 414 382-4444
European Headquarters SA/NV, Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 06 00, Fax: (32) 2 663 06 40
Asia Pacific Headquarters, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

